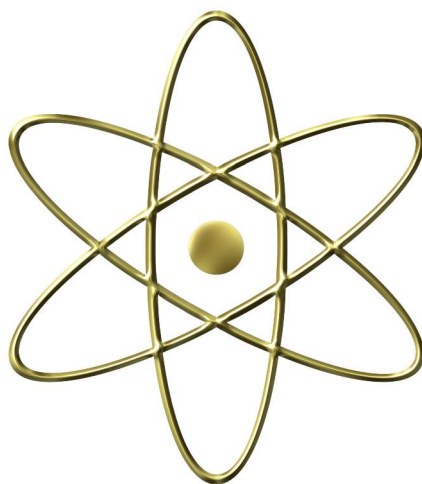


# **The Journal of American Science**



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# The Journal of American Science

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2	<p><b>Efficiency of Different Biocontrol Agents on both Susceptible and Resistant Bean Plants and their Protein Pattern Consequences</b></p> <p>Ayman A. Farrag</p> <p>Botany and Microbiology Department, Faculty of Science (Boys), Al-Azhar University, Cairo, Egypt.  <a href="mailto:dardear2002@yahoo.com">dardear2002@yahoo.com</a></p> <p><b>Abstract:</b> Five <i>Streptomyces</i> Spp. namely <i>St. albadncus</i>, <i>St. vastus</i>, <i>St. griseoplanus</i>, <i>St. murinus</i> and <i>St. lydicus</i> were screened for their efficiency to control <i>Rhizoctonia solani</i> root rot pathogen <i>in vitro</i>. Results proved that <i>Streptomyces lydicus</i> was the most potent biocontrol agents against the fungal pathogen tested. However, the experiment was conducted to a greenhouse to investigate the differences in protein pattern between resistant and susceptible varieties of bean plants in response to biological control to investigate the mechanism of pathogen related protein in pathogenicity. Results <i>in vivo</i> showed that the biocotol used obviously reduced the infection percentage up on susceptible bean variety down to 94/22 and for resistant variety to 39/6. Accordingly, the growth parameters also revealed that the response of the susceptible plants were generally more than that of the resistant one. Interestingly, results of protein pattern clarify that the highest protein bands as well as the unique bands were only detected in both susceptible control and resistant infected bean plants treated with the biocontrol agent respectively. Furthermore, the genetic distance (GD) results revealed that the highest GD was detected also between the two mentioned treatments. In addition, the data obtained from the genetic similarity of protein pattern proved that the lowest similarity was also between both the susceptible control and resistant infected bean plants treated with biocontrol agent respectively. Amazingly, the highest genetic similarity of protein pattern was detected between both susceptible infected bean plants treated with biocontrol and resistant control one. Finally, our results suggested that there are a great similarity between the susceptible infected variety treated with biocontrol agent and the resistant control untreated variety but not between the resistant infected variety treated with biocontrol agent and the susceptible control untreated variety. This may also give an impression that the</p>	<p><a href="#">Full Text</a></p> <p>2</p>

	<p>pathogen resistant protein (PR) works independently in the susceptible plants but works dependently in the resistant one.</p> <p>[Ayman A. Farrag. Efficiency of Different Biocontrol Agents on both Susceptible and Resistant Bean Plants and their Protein Pattern Consequences. Journal of American Science 2011;7(4):7-14]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Biological control; <i>Streptomyces Spp.</i>; <i>Phaseolus vulgaris</i>; Electrophoresis protein pattern</p>		
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	<p>educated, well paid and urban consumers. Elderly, low-educated, low-paid and rural residents are among those who use the Internet the least. In our post-modern network society they are at the risk of social exclusion. This paper is aimed at the analysis of ICT diffusion in rural communities of Lithuania, exploring the main social patterns of diffusion and characteristics of rural Internet users. The study is based on focus group discussions and questionnaire-based survey of Lithuanian rural residents. The paper discusses types of change agents involved in the processes of ICT diffusion in rural communities and the main motives for using the Internet. It also explores the impact of ICT on ways of private communication and communication with relevant public authorities, discusses both positive and negative attitudes to ICT use in everyday life activities.</p> <p>[Mohammad Abedi and Sharareh Khodamoradi. <b>Social dimensions of Information and Communication Technologies (ICT) diffusion in rural communities in developing countries</b>. Journal of American Science 2011;7(4):26-30]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Information and Communication Technologies (ICT), rural communities, developing countries</p>		
6	<p><b>Effects Of Aloe Vera (<i>Aloe Barbadensis</i>) Aqueous Leaf Extract On Testicular Weight, Sperm Count And Motility Of Adult Male Sprague-Dawley Rats.</b></p> <p>Oyewopo A.O.<sup>1</sup>, Oremosu A.A.<sup>2</sup>, Akang E.N.<sup>2</sup>, Noronha C.C.<sup>2</sup>, And Okanlawon A.O.<sup>2</sup></p> <p><sup>1</sup> Department of Anatomy, College of Health Sciences, University of Ilorin</p> <p><sup>2</sup> Department of Anatomy, College of Medicine, University of Lagos</p> <p>Address correspondence to Akang, Edidiong N. e-mail: <a href="mailto:eltyeddy@gmail.com">eltyeddy@gmail.com</a></p> <p><b>ABSTRACT:</b> Aloe Vera has been widely reported for its numerous medicinal effects but little is known of its effects on the reproductive organs. This study investigated the effects of Aloe Vera aqueous leaf extract on testicular weight and semen parameters of Sprague-Dawley rats. Twenty- four adult male Sprague-Dawley rats weighing between 130-150 grams were divided into 4 groups. The experimental groups; B, C and D received oral doses of 30 mg/kg, 70 mg/kg and 100 mg/kg body weight of aqueous extract of Aloe Vera respectively; while, the control (Group A) received equal volume of distilled water for the duration of a complete spermatogenic cycle. The rats were sacrificed on the 57<sup>th</sup> day, the testes excised, weighed and processed for microscopic examination. The results showed that sperm count of rats that received 70 mg/kg and 100 mg/kg of Aloe Vera extract decreased significantly when compared with the control. However the decrease in sperm motility and testicular weight was not statistically significant across the groups. These results suggest that Aloe Vera has potential antifertility effects in the male rat.</p> <p>[Oyewopo A.O., Oremosu A.A., Akang E.N., Noronha C.C., And Okanlawon A.O. <b>Effects Of Aloe Vera (<i>Aloe Barbadensis</i>) Aqueous Leaf Extract On Testicular Weight, Sperm Count And Motility Of Adult Male Sprague-Dawley Rats</b>. Journal of American Science 2011;7(4):31-34]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>KEYWORDS:</b> Aloe Vera, testicular weight, sperm count, sperm motility</p>	<a href="#">Full Text</a>	6
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	<p style="text-align: center;"><b>managers in Iran</b></p> <p style="text-align: center;">Farhad Lashgarara<sup>1</sup>, Syamak Zafarmoradian<sup>2</sup>, Mohammad Hossein Razaghi<sup>3</sup>  <sup>1,2,3</sup>. Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran  <a href="mailto:f_lashgarara@sbiau.ac.ir">f_lashgarara@sbiau.ac.ir</a></p> <p><b>Abstract:</b> The purpose of this study is to evaluate the role of knowledge management in performance of the country's forest, rangeland, and watershed organization's managers. This is applied and non-experimental (descriptive) research. The methodology of research is correlation. Questionnaire is main instrument in research. Statistical population in this study was 300 executives of the Forest, Rangeland and Watershed of country; based on census, 239 respondents have completed the sent questionnaires. For measuring study tool's validity the questionnaire was given to researchers, experts, and the organization's managers associated with the subject in the ministry of Agricultural organization, and a primary-test by completing 30 questionnaires and for measuring reliability, the questionnaire was taken and the Cronnbach alpha coefficient was 84 percent. The results showed that the organization's managers familiarity with knowledge management was weak and In regarding the prioritizing dimensions of knowledge management, identifying knowledge was in highest priority. Multiple regression results showed that using knowledge, preserving knowledge and acquiring knowledge variables determined 31.5% the performance of managers of the country's forest, rangeland, and watershed organization. [Farhad Lashgarara, Syamak Zafarmoradian, Mohammad Hossein Razaghi. Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran. Journal of American Science 2011;7(4):42-45]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> knowledge management, knowledge, managers, performance</p>	<a href="#">Text</a>	
9	<p style="text-align: center;"><b>Genotoxic Effects Of Organophosphate Pesticide Phorate In Some Exotic Fishes Of Kashmir</b></p> <p style="text-align: center;">Maraj-ud-din Malik<sup>1</sup>, Farooq Ahmad Ganai<sup>*2</sup>, MD Niamat Ali<sup>1</sup> and Zeenat Nisar<sup>1</sup>  <sup>1</sup>P.G. Department of Zoology, University of Kashmir, 190006, India  <sup>2</sup>Limnology and Fisheries Laboratory, Centre of research for Development, University of Kashmir-19006, India.  <b>*Corresponding author:</b> Farooq Ahmad Ganai, Email: <a href="mailto:farooqmd84@gmail.com">farooqmd84@gmail.com</a>.</p> <p><b>ABSTRACT:</b> Genotoxic effects of phorate, a commonly used pesticide were evaluated in two exotic sub-species of fish, <i>Cyprinus carpio</i> L. (family <i>Cyprinidae</i>) namely <i>Cyprinus carpio specularis</i> and <i>Cyprinus carpio communis</i> using micronucleus test. Genotoxicity of said pesticide was confirmed by incidence of micronucleus in peripheral erythrocytes using three sub-lethal concentrations viz 0.2ppm, 0.4ppm and 0.6ppm of phorate after 24, 48 and 72 hours. All the three concentrations were able to induce micronuclei formation in erythrocytes of both fish species. However, after 48h and 72h, a statistically significant increase was found in the frequency of micronuclei in peripheral erythrocytes of both fish species. The percentage of single micronuclei in <i>Cyprinus carpio specularis</i> (0.03 ± 0.01 in control) increased to 1.15 ± 0.32 from low to high concentrations after 24h and 2.74 ± 0.52 in longer exposures. In <i>Cyprinus carpio communis</i> somewhat similar results were observed with increase in percentage of single micronuclei (0.03 ± 0.01 in control) to 1.30 ± 0.23 at 24h from low to high concentration and this percentage continued to increase by 2.08 ± 0.31 and 2.91 ± 0.39 after 48 and 72 h respectively ( Mann-Whitney U test; p&lt; 0.05). [Maraj-ud-din Malik, Farooq Ahmad Ganai, Niamat Ali and Zeenat Nisar. <b>Genotoxic Effects Of Organophosphate Pesticide Phorate In Some Exotic Fishes Of Kashmir</b>. Journal of American Science 2011;7(4):46-50]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Micronucleus; <i>Cyprinus</i>; Phorate; Genotoxicity; Pesticide</p>	<a href="#">Full Text</a>	9
10	<p style="text-align: center;"><b>Role of Some Insects in Transmission Some Apple Orchard Diseases in Egypt</b></p> <p style="text-align: center;">Shadia E. Abd El-Aziz<sup>1</sup>, N.Y. Abd El-Ghafar<sup>2</sup> and E.M.Embaby<sup>3*</sup>  <sup>1</sup> Pests &amp; Plant Protection Dept., National Research Centre  <sup>2</sup>. Plant Pathology Dept., Faculty of Agriculture, Ain Shams Univ.  <sup>3</sup>. Plant Pathology Dept., National Research Centre, Egypt  <a href="mailto:embaby.elsayed@yahoo.com">*embaby.elsayed@yahoo.com</a></p> <p><b>Abstract:</b> Insects are probably the most important agents for spreading certain pathogenic diseases. Honeybee,</p>	<a href="#">Full Text</a>	10

	<p><i>Apis mellifera</i> and rose chafer beetle, <i>Epicometis (Tropinota) squalida</i> played an important role to disseminate plant pathogenic diseases. Isolation from diseased apple orchard trees (<i>Malus domestica</i>) at EL-Nobaria location, Behira Governorate, Egypt, resulted that, three bacterial genera i.e. <i>Erwinia amylovora</i>, <i>Pseudomonas syringae</i>, <i>P. cichurii</i> and <i>Planococcus</i> spp., in addition the fungus <i>Monilinia mali</i> were isolated and identified from infected apple samples. <i>Erwinia amylovora</i> and <i>P. syringae</i> were the most frequency than others which recorded 30%, followed by <i>M. mali</i> fungus which gave 20%. Both <i>P. cichurii</i> and <i>Planococcus</i> spp. were the less frequency and each occurred with 10%. Honeybee (<i>Apis mellifera</i>) and rose chafer (<i>E. squalida</i>) insects were more efficacy to borne and transfer <i>M. mali</i> fungus, <i>E. amylovora</i> and <i>P. syringae</i> as externally than internally. Population of these pathogens and percentage of contaminated insects were more effective during February and March than April. <i>A. mellifera</i> was more efficacy than <i>E. squalida</i> to transmit bacterial pathogens compared with pathogenic fungus. Meanwhile, <i>E. squalida</i> was more efficacy than <i>A. mellifera</i> to transmit pathogenic fungus than bacteria. However, insects were the most efficacious to transfer all tested pathogens mechanically. <i>A. mellifera</i> was more effective than <i>E. squalida</i> to transmit all tested pathogens.</p> <p>[Shadia E. Abd El-Aziz, N.Y. Abd El-Ghafar and E.M.Embaby. Role of Some Insects in Transmission Some Apple Orchard Diseases in Egypt. Journal of American Science 2011;7(4):51-59]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Apple diseases, <i>Erwinia amylovora</i>; <i>Pseudomonas syringae</i> bacteria; <i>Monilinia mali</i> fungus; <i>Apis mellifera</i>; <i>Epicometis squalida</i>; insects</p>		
11	<p style="text-align: center;"><b>Moisture-Dependent Dielectric Properties of Pea and Black-Eyed Pea</b></p> <p style="text-align: center;">Mahmoud Soltani, Reza Alimardani Department of Agricultural Machinery Engineering, Faculty of Agricultural Engineering &amp; Technology, University of Tehran, Karaj, Iran. <a href="mailto:mahmoodsoltani39@yahoo.com">*mahmoodsoltani39@yahoo.com</a></p> <p><b>Abstract:</b> In this paper, a cylindrical capacitor was used to measure dielectric constant of seeds. By measuring the dielectric constant, the moisture content of grains may be predicted. Change in dielectric constant of pea and black eyed-pea was investigated as a function of moisture content. Results showed that dielectric constant was highly depended on moisture content at all frequencies. The best results were obtained at 1 MHz frequency for pea and black-eyed pea with <math>R^2</math> of 0.994 and 0.999 respectively. This frequency could be used to calibrate the instrument for measuring the moisture content of pea and black eyed-pea.</p> <p>[Mahmoud Soltani, Reza Alimardani Moisture dependent dielectric properties of Pea and Black-Eyed Pea. Journal of American Science 2011;7(4):60-64]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> dielectric constant, Instrumentation, Moisture content, seed</p>	<a href="#">Full Text</a>	11
12	<p style="text-align: center;"><b>An LMI Approach to Design Dynamic Output Feedback Control for Stochastic Hybrid Systems</b></p> <p style="text-align: center;">Fatemeh Jamshidi <sup>1</sup>, Afshin Shaabany <sup>1</sup> <sup>1</sup> Islamic Azad University, Fars Science and Research Branch, Shiraz, Iran <a href="mailto:Fjamshidi59@yahoo.com">Fjamshidi59@yahoo.com</a>, <a href="mailto:afshinshy@yahoo.com">afshinshy@yahoo.com</a></p> <p><b>Abstract:</b> This paper deals with the stabilization of a class of uncertain stochastic hybrid systems. The uncertainties are norm bounded type. Under the complete access to the system mode a dynamic output feedback controller that makes the closed-loop dynamics of this class of systems regular, impulse-free and stochastically stable is designed. The state space matrices of this controller are the solution of some linear matrix inequalities (LMIs).</p> <p>[Fatemeh Jamshidi, Afshin Shaabany. An LMI Approach to Design Dynamic Output Feedback Control for Stochastic Hybrid Systems. Journal of American Science 2011;7(4):65-70]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Stochastic systems; Stabilization; Dynamic output feedback control; LMI.</p>	<a href="#">Full Text</a>	12
13	<p style="text-align: center;"><b>Influence of Some Rootstocks on the Performance of Red Globe Grape Cultivar</b></p> <p style="text-align: center;">Rizk-Alla, M.S.; Sabry, G. H. and Abd El-Wahab, M.A. Viticulture Dept., Hort. Res. Instit., Agric. Res. Center, Giza, Egypt <a href="mailto:mohamedabdelaziz2003@yahoo.com">mohamedabdelaziz2003@yahoo.com</a></p>	<a href="#">Full Text</a>	13



	<p><b>Abstract:</b> This investigation was conducted for three successive seasons (2008, 2009 and 2010) in a private vineyard located at El-Khatatba, Menoufiya governorate; to study the growth, yield and fruit quality of Red Globe grape cultivar grafted onto some rootstocks; Dogridge, Salt creek, Freedom, Harmony, and Paulsen 1103 in addition to own-rooted vines. The chosen vines were five-year-old, grown in a sandy loam soil, spaced at 2 X 3 meters apart, irrigated by the drip irrigation system, cane-pruned and trellised by the Spanish Parron system. The results showed that all rootstocks especially Dogridge, Salt creek and Freedom were effective in increasing the yield and its components, ensuring the best physical properties of bunches, improving the physical and chemical characteristics of berries, achieving the best vegetative growth parameters (i.e. average shoot diameter, average shoot length, average number of leaves/ shoot, average leaf area, total leaf area/vine, coefficient of wood ripening and weight of prunings) and increasing leaf content of total chlorophyll and percentages of total nitrogen, phosphorus and potassium as well as cane content of total carbohydrates in comparison with the non grafted vines. The economical study indicated that Red Globe grapevines grafted on Dogridge, Salt creek, Freedom, Harmony, and Paulsen 1103 rootstocks gave the maximum net profit compared with the own-rooted vines.</p> <p>[Rizk-Alla, M.S.; Sabry, G. H. and Abd El-Wahab, M.A. <b>Influence of Some Rootstocks on the Performance of Red Globe Grape Cultivar.</b> Journal of American Science 2011;7(4):71-81]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> rootstocks, grafted, vines, Red Globe Grape.</p>		
14	<p style="text-align: center;"><b>The Methods Of Human Behavior Control In Traffic Control</b></p> <p style="text-align: center;">Qing Zhao<sup>1</sup>, Jing Chen<sup>1</sup>, Jianjun Shi<sup>1</sup></p> <p style="text-align: center;"><sup>1</sup> Department of Transportation Engineering ,Beijing University of Technology, Chaoyang Dist100124, Beijing, China. <a href="mailto:zhaoqing1202@gmail.com">zhaoqing1202@gmail.com</a></p> <p><b>Abstract:</b> Achieving better traffic control is always an enduring issue during these years, however a reasonable answer for this issue has not been got due to a number of factors that are involved in this issue and the complexity of the transport system itself. The key of traffic control is defining person as the object of traffic control, rather than car and traffic lights. Traffic control really works only when the implementation of traffic control could make the traveler's behavior more rational and safer and further format the more safe and effective traffic environment. Therefore, it is critical to undertake a study of human behavior control in traffic control. This study clarified the definition of human behavior in the field of traffic control and conducted a discussion on the controllability of human behavior in order to introduce a concept of traffic behavior control. In addition, according to the application of behavior in other subjects, 'Traffic Man' which is the object of traffic behavior control was introduced and the characteristics of this concept were also be analyzed in this study. Consequently, the main methods of human behavior traffic control were obtained based on the relationship of consciousness and behavior, the aspect of traffic behavior's feedback as well as traffic demand respectively.</p> <p>[Qing Zhao, Jing Chen, Jianjun Shi. <b>The Methods Of Human Behavior Control In Traffic Control.</b> Journal of American Science 2011;7(4):82-87]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> traffic behavior ; traffic behavior control; Traffic man ; traffic behavior consciousness ; traffic behavior control method</p>	<a href="#">Full Text</a>	14
15	<p style="text-align: center;"><b>Reviews the most important factors in improving criteria of rural women's empowerment</b></p> <p style="text-align: center;"><sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi</p> <p style="text-align: center;"><sup>1, 2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran</p> <p style="text-align: center;">*Corresponding author: <a href="mailto:abedi114@yahoo.com">abedi114@yahoo.com</a></p> <p><b>Abstract:</b> Rural women's financial self-reliance has many social &amp; economic influence as it made them self-sufficiency, it changes economic behavior and it makes women independent, it will be effective in economic development in family &amp; society , it also improve the women's roles in society and it causes self-confidence in women , it builds family strength and it causes to respect the women rights more than before and women will become equal with men in all their rights, of course we won't have patriarchy in the family . The women's</p>	<a href="#">Full Text</a>	15

	<p>empowerment in the rural society will increase because of all the aspects of rural women's self-reliance and their position will be confirmed. By the activities such as promotional services for increasing the rural women's skills in various fields and by increasing the rural women's knowledge in social, politic, cultural and economic fields and by using micro-credit plans for motivate and support women in economic development and their self-reliance, we can increase the rural women's empowerment.</p> <p>[Ali Badragheh and Mohammad Abedi. <b>Reviews the most important factors in improving criteria of rural women's empowerment.</b> Journal of American Science 2011;7(4):88-92]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> self-reliance, empowerment</p>		
16	<p><b>The General Equation Of Pipe To Soil Potential During Humidity Change By The Use Of Both Soil Factor and Protection Current For Pipe – Soil – Earth System</b></p> <p>Ashraf Abdel Raouf Mohamed Fouad Ahmed</p> <p><a href="mailto:Ashrafahmed9000@yahoo.com">Ashrafahmed9000@yahoo.com</a></p> <p><b>Abstract:</b> For pipe-soil-earth system, the buried pipe line segment with soil surrounding medium could be simulated electrically by an electric circuit where the system is subjected to the law: charge = capacitance × voltage between the pipe surface and remote earth. This is where each of circuit electric parameter (electrolytic stray capacitor between pipe &amp; earth, the stray potential across the stray capacitor, surface charge and the protection current of the cathodic protection system passed through the pipe segment ) could be obtained by an equation which is function of the measured electrochemical properties of the soil (soil factor), 4<sup>th</sup> degree polynomial at room temperature but the A's constants are different for each electric quantity .These constants of each equation (A's) considered to be as a print of such pipe-soil-earth system . The useful of these prints is to obtain complete electrical data correlated with many cathodic protection levels. One of the most critical problems in CP systems is the effect of a sudden change of the soil humidity around the protected pipe line. The behavior of the protection current demand of the pipe-soil-earth system during the change of the electrochemical properties of the soil could be plotted as protection current print which will be always valid in all times as the pipe-soil-earth system is maintained and without any external interference. In other words, if the system is subjected to humidity change, there will be another new protection current demand with new print for this pipe-soil-earth system to keep the pipe cathodically protected. Of course, as a result of humidity change, the pipe to soil potential will be changed. This paper tries to calculate segmental pipe to soil potential along the pipe line without the need of both the test point and Cu/CuSO<sub>4</sub> half cell by a general equation of the pipe to soil potential which is function of both the segmental protection current and the soil factor around the pipe segment during such humidity change.</p> <p>[Ashraf Abdel Raouf Mohamed Fouad Ahmed. <b>The General Equation Of Pipe To Soil Potential During Humidity Change By The Use Of Both Soil Factor and Protection Current For Pipe – Soil – Earth System.</b> Journal of American Science 2011;7(4):93-102]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Electrical study of pipe – soil – earth system</p>	<a href="#">Full Text</a>	16
17	<p><b>Indigenous knowledge and need for integration with modern science</b></p> <p><sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi</p> <p><sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran</p> <p>*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> main reason for inattention for native knowledge in third world countries is that colonist countries don't pay any attention to the peoples' knowledge and information in these countries and always have reminded the people of these colonized countries as a stubborn, superstitious and retrogressive people . On the other hand, the colonist countries attention to industrial productions and agriculture policies has caused to promote industrial and single product agriculture which will influence the native farmer's knowledge about different productions and will make it inconspicuous. Also, colonized plans and imported extension programs have intensified the alienation of native knowledge . In the middle of 1980 decade, there was a new view" giving priority to farmer" that increased the attention to native knowledge.</p> <p>[Ali Badragheh and Mohammad Abedi. <b>Indigenous knowledge and need for integration with modern science.</b> Journal of American Science 2011;7(4):103-108]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p>	<a href="#">Full Text</a>	17



	<b>Keywords:</b> indigenous knowledge, modern science		
18	<p style="text-align: center;"><b>Increasing social participation of rural women through micro-credit</b></p> <p style="text-align: center;"><sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi</p> <p style="text-align: center;"><sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> In all communities, rural women are considered as an important factor in achieving rural development goals and in fact are half of the manpower needed for rural development. However, in the rural community of Iran, there are gaps between the ruling class (capital owners) and villagers, between literate and illiterate, and between men and women. Especially in villages women have fewer possibilities in terms of investment and less power and credit. Role of rural women, over of men, is more influenced with different economic, social, cultural and ecologic factors. Rural women are considered as a noticeable potential in the community either directly (crops production, livestock, handicrafts, cottage industries) or indirectly by helping the agricultural sector (as labor). About 5.6 million women are involved in agricultural production, and activities related to planting... harvesting, preparation of animal food, and taking care of livestock and poultry and some certain activities related to trading and marketing are all different fields of rural women's role and participation. Based on current statistics, women in rural area participate about 50% in conversion industries, 22% in producing crops and livestock, 75% in handicrafts and in areas related to planting...harvesting , respectively, 25, 24 and 4.26. And also in activities related to livestock, they handle 23% of livestock grazing, 42% of animal care and 100 percent of total poultry in the village.</p> <p>[Ali Badragheh and Mohammad Abedi. <b>Increasing social participation of rural women through microcredit.</b> Journal of American Science 2011;7(4):109-114]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> participation, rural women, micro-credit</p>	<a href="#">Full Text</a>	18
19	<p style="text-align: center;"><b>A Simulation Investigation on Impacts of Transportation Disruption for Vendor Managed Inventory Model and Traditional Inventory System</b></p> <p style="text-align: center;">Afsaneh Noori Houshyar<sup>1</sup>, Soroush Avakh Darestani<sup>2</sup>, Azadeh Noori Hoshyar<sup>3</sup>, Muriati Mukhtar<sup>1</sup>, Riza Sulaiman<sup>1</sup></p> <p style="text-align: center;">1. Department of Industrial Computing, University Kebangsaan Malaysia, 43000, Malaysia</p> <p style="text-align: center;">2. Department of Industrial and Mechanical Engineering, Islamic Azad University, Qazvin Branch, Iran</p> <p style="text-align: center;">3. Department of Computer Science, University Kebangsaan Malaysia, 43000, Malaysia</p> <p style="text-align: center;">A_nh86@yahoo.com</p> <p><b>Abstract:</b> Nowadays, Supply Chain Management (SCM) becomes an important issue and involves managing integrated information about product flow, improving efficiencies. One of the important issues of SC is implementing close coordination and relationship among its members. This paper considers two different approach of inventory management which called Traditional Inventory Management (TIM) and Vendor Managed Inventory (VMI) and propose a simulation method to observe the impacts on system efficiency and average inventory level while a transportation disruption situation happened through supply chain comparing with a normal situation. The stimulated members of SC are such as Distributor and Manufacturer. The model supposed that Manufacturer as a producer member has two separate warehouses which called here Raw Material and Product inventories. The models were simulated for 34 months (12,000 hours) by five times replications. Likewise, a disruption is supposed about two months thorough transportation on supply chains. The results show that the reduction of efficiency for TIM model was 17% while for VMI it was obtained by 12% when the disruption occurred in SC. In this context, it can be concluded that VMI is less sensitive when disruption happened and TIM is more vulnerable rather than VMI. The reason belong to this result is due to a great information sharing through all supply chain members. Furthermore, the fluctuation of average inventory level occurred much more on TIM rather than VMI. In proposed VMI model, manufacturer inventory (Product) experienced the largest fluctuation in its average inventory level and it is the most sensitive partner while disruption occurred. However, distributor member in TIM experienced the largest fluctuation in its average inventory level, therefore, it is the most sensitive member</p>	<a href="#">Full Text</a>	19

	<p>towards transportation disruption. [Afsaneh Noori Houshyar, Soroush Avakh Darestani, Azadeh Noori Hoshyar, Muriati Mukhtar, Riza Sulaiman. <b>A Simulation Investigation on Impacts of Transportation Disruption for Vendor Managed Inventory Model and Traditional Inventory System.</b> Journal of American Science 2011;7(4):115-133]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Vendor Managed Inventory (VMI), Supply Chain (SC), Electronic Data Interchange (EDI), Simulation, Traditional Inventory Model (TIM), Transportation Disruption.</p>		
20	<p><b>Electrochemical Degradation of some Pesticides in Agricultural Wastewater</b></p> <p><b>Abdel-Gawad S.A.<sup>*1</sup>, Omran K. A.<sup>2</sup>, Mokhatar M. M.<sup>2</sup> and Baraka A. M.<sup>1</sup></b></p> <p><sup>1</sup>Chemistry Department, Faculty of Science, Cairo University, Egypt <sup>2</sup>Central Laboratory for Environmental Quality Monitoring (CLEQM), National Water Research Center (NWRC) <a href="mailto:soha.gawad@yahoo.com">*soha.gawad@yahoo.com</a></p> <p><b>Abstract:</b> This work deals with the possibility of using graphite electrodes for the electro-catalytic oxidation process of some pesticides (malathion, imidacloprid and chlorpyrifos). The graphite electrodes were used in the combined process in the presence of transition metals modified kaolin catalyst. The results of the electrolytic oxidation were expressed in term of chemical oxygen demand (COD) removal, which was determined instrumentally. The highest efficiency of COD removal was obtained in the presence of the transition metals modified kaolin catalyst. The different operating conditions of electro-catalytic oxidation process were studied which include: current density, pH, electrolysis time and initial pesticide concentration. The optimum operating conditions for the above mentioned electrode were determined. [Abdel-Gawad S. A., Omran K. A., Mokhatar M. M. and Baraka A. M. <b>Electrochemical Degradation of some Pesticides in Agricultural Wastewater.</b>] Journal of American Science 2011;7(4):134-145]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Graphite electrode, electro-catalytic degradation transition metals modified kaolin catalyst, combined electrochemical oxidation, pesticides.</p>	<a href="#">Full Text</a>	20
21	<p><b>A study on Required Characteristics of Effective Teachers in Entrepreneurship Education in Iran</b></p> <p>Farhad Lashgarara</p> <p>Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran <a href="mailto:f_lashgarara@sbiau.ac.ir">f_lashgarara@sbiau.ac.ir</a></p> <p><b>Abstract:</b> Entrepreneurship is a way an individual relates to his/her environment be the economic environment or the social environment. Hence, entrepreneurship is important for improve backwardness of the people, economic development of the region, eradication of regional imbalances and better economic gain. Independence, propensity to take risk, personal modernity is some of the characteristics of an entrepreneur. Some scholars argue that education and training need to be placed at the forefront of entrepreneurship. Entrepreneurship education is realized to be a mean of enhancing human capacity. Consequently, there is a great demand for education in all aspects of development. Agricultural education teachers have the knowledge and skills for preparing students to become entrepreneurs who will pass on knowledge to future generations through teaching and practicing the principles acquired at school. In addition, agriculture teachers have the potential to create awareness of entrepreneurship practices among students. The main purpose of this research is identification of required characteristics of effective teachers in entrepreneurship education in Iran. [Farhad Lashgarara, <b>Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran.</b> Journal of American Science 2011;7(4):146-150]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Characteristics, Effective, Agricultural teachers, Entrepreneurship</p>	<a href="#">Full Text</a>	21
22	<p><b>A Study on Impacts on Global Warming on Sustainable Agriculture</b></p>	<a href="#">Full</a>	22

	<p style="text-align: center;">Farhad Lashgarara <sup>1</sup>, Nayyereh Karkeh Abadi <sup>2</sup></p> <p><sup>1, 2</sup>. Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran  <a href="mailto:f_lashgarara@srbiau.ac.ir">f_lashgarara@srbiau.ac.ir</a></p> <p><b>Abstract:</b> Agriculture is a human activity that is intimately associated with climate. It is well known that the broad patterns of agricultural growth over long time scales can be explained by a combination of climatic, ecological and economics factors. Sustainable agriculture can be broken into three components: economic, environmental, and social. A major concern in the understanding of the impacts of climate change is the extent to which agriculture will be affected. Global climate change has become an important area of investigation in natural sciences and engineering, and irrigation has often been cited as an area in which climate change may be particularly important for decision- making. Although climate change is expected to have a significant impact on water availability and irrigation requirements, the extend and effect on the water resources planning and management process remains largely unknown. Climate change has many effects on the hydrological cycle and thus, on water resources systems. Global warming could result in changes in water availability and demand, as well as in the redistribution of water resources, in the structure and nature of water consumption, and exasperate conflicts among water users. Impact of global warming on crop water requirements plays a role of paramount importance in assessing irrigation needs. The planning and design process needs to be sufficiently flexible to incorporate consideration of and responses to many possible climate impacts. The main factors that will influence the worth of incorporating climate change into the process are the level of planning, the reliability of the forecasting.</p> <p>[Farhad Lashgarara, Nayyereh Karkeh Abadi. Department of Agricultural Extension, Science and Research Branch, Islamic Azad University, Tehran, Iran. Journal of American Science 2011;7(4):151-156]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Warming, Global warming, Sustainable agriculture, Forecasting</p>	<a href="#">Text</a>	
23	<p style="text-align: center;"><b>Improving Secondary Collection of Solid Waste: The Experience of Performance Based System in Lahore</b></p> <p style="text-align: center;">Rizwan Hameed<sup>1</sup>, Shahida Nazir<sup>2</sup></p> <p><sup>1</sup>Department of City and Regional Planning, University of Engineering and Technology, Lahore, Pakistan  <a href="mailto:d_rizwan@hotmail.com">d_rizwan@hotmail.com</a></p> <p><sup>2</sup>HEC Focal Person Office, Research Centre, University of Engineering and Technology, Lahore, Pakistan  <a href="mailto:shahidams05@hotmail.com">shahidams05@hotmail.com</a></p> <p><b>Abstract:</b> Like cities of many developing countries, solid waste management in Lahore is a serious challenge and constrained by economic, institutional and operational factors. The Solid Waste Management Department (SWMD) of the City District Government Lahore (CDGL) initiated a performance based system (PBS) of secondary collection of waste with the view to improve the service and make effective use of the available resources. The paper provides an assessment of the new system using data regarding various aspects of waste collection service under the PBS and discussions with concerned officials. The analysis of data shows that there are signs of improvement both in terms of quantity of waste now lifted and brought to dumping site as well as the cost incurred on this service. The paper concludes that there is scope for replicating this system all across the city but certain aspects need to be given due consideration to ensure its smooth operation in the long run.</p> <p>[Rizwan Hameed, Shahida Nazir. <b>Improving Secondary Collection of Solid Waste: The Experience of Performance Based System in Lahore</b>. Journal of American Science 2011;7(4):157-164]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Performance Based System (PBS); Solid Waste Management; Secondary Collection; City District Government; Lahore.</p>	<a href="#">Full Text</a>	23
24	<p style="text-align: center;"><b>Studying the Possible Impact of Agricultural Audiovisual Programs on Farm Productivity</b></p> <p style="text-align: center;">Farshad Parvizia</p>	<a href="#">Full Text</a>	24

	<p>M.Sc., Eng., Department of Rural Development, Science and Research branch, Islamic Azad University (IAU), Tehran, Iran. <a href="mailto:Farshad48@yahoo.com">Farshad48@yahoo.com</a></p> <p><b>Abstract:</b> Agricultural extension, which is essentially a message delivery system, has a major role to play in agricultural development. It serves as a source of advice and assistance for farmers to help them improving their production and marketing. The task of extension education is accomplished by different extension methods/media, which may come under individual, group and mass contacts. This paper investigates the possible impact that agricultural audiovisual programs could have on farm productivity. It is indicated that an agricultural information program via a combination of television broadcast and video group screening would be justifiable to the Government is a current agricultural extension activity. The article also assists the authorities in improving an agricultural development system to support current extension activities via audio-visual mass media. [Farshad Parvizian. Studying the Possible Impact of Agricultural Audiovisual Programs on Farm Productivity. Journal of American Science 2011;7(4):165-169]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Impact, Agriculture, Audiovisual Programs, Farm, Productivity</p>		
25	<p style="text-align: center;"><b>Representation of Women's Role in Iranian TV Series</b></p> <p style="text-align: center;">Mehrdad Navabakhsh<sup>1</sup>, Sayeh Bigdeli Ghomi<sup>2</sup></p> <p><sup>1</sup>. PhD, Associate Professor, Department of sociology, Faculty of Humanities and Social Sciences, Science and Research Branch, Islamic Azad University (IAU), Tehran, Iran</p> <p><sup>2</sup>. PhD Student, Department of Communication Sciences, Faculty of Humanities and Social Sciences, Science and Research Branch, Islamic Azad University (IAU), Tehran, Iran <a href="mailto:sayehbigdeli@yahoo.com">sayehbigdeli@yahoo.com</a></p> <p><b>Abstract:</b> The concept of representation has a central aspect in media studies. This concept is closely related to the efforts, which are done to draw reality. Considering the importance of women in the family institution in Islamic Republic of Iran, one of the important tasks of Islamic Republic of Iran Broadcasting (IRIB) is strengthening the women status and improving the levels of community mental health for women. Three decades after the political revolution of 1978, the figure of the woman remains a pivotal point in the Iranian public discourse. This article endeavors to unravel the dominant gender ideology of Iranian television by decoding one of its popular T.V series. It argues that this T.V series represents Iranian women as 'otherization' of the Western women. Furthermore, it argues that the hegemonic aspect of this T.V series has been able to win the trust of many Iranian viewers. It is theoretically based on the 'theory of discourse' developed by Ernesto Laclau and Chantal Mouffe. The methodologies which have been applied in this study include textual analysis and in-depth interview. In this article the role of women in the most Iranian popular family series of television (Coma with 84/2 percent of viewers) has been evaluated by using content analysis techniques during the first six months of the year 2007.</p> <p>[Mehrdad Navabakhsh, Sayeh Bigdeli Ghomi. Representation of Women's Role in Iranian TV Series. Journal of Journal of American Science 2011;7(4):170-173]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Representation, Women's Role, TV Series, Gender, Media</p>	<a href="#">Full Text</a>	25
26	<p style="text-align: center;"><b>Semantic processing of Arabic language</b></p> <p style="text-align: center;">Maryam Al-Sadat Hoseini</p> <p>M.Sc., Department of Arabic literature, Faculty of Literature and Foreign Languages, University of Al-Zahra, Tehran, Iran. <a href="mailto:m.hoseini1363@yahoo.com">m.hoseini1363@yahoo.com</a></p> <p><b>Abstract:</b> In spite of the fact that Arabic offers a well-studied theoretical and historical linguistic knowledge, unfortunately, it has so far received very little computational research and in particular on the level of logical compositional analysis. Furthermore representing Arabic sentences as logic programs has the facility of performing some semantic reasoning tasks on a code based on Arabic predicates. This work is therefore attempting to fill some</p>	<a href="#">Full Text</a>	26

	<p>essential aspects of this gap in introducing a logic-based compositional model covering fundamental issues involved in semantic analysis of Arabic sentences. The focus of attention is relying on studying the compositionality of important Arabic syntactical constituents and on extending the concept of the generalized natural language quantification to Generalized Arabic Quantifiers GAQ utilizing lambda-calculus and the type theoretical analysis of Arabic structure. Since semantic representation has to be compositional in natural language understanding systems this approach attempts to propose an element framework for developing more practical and intelligent Arabic natural language processing systems.</p> <p>[Maryam Al-Sadat Hoseini. Semantic processing of Arabic language. Journal of American Science 2011;7(4):174-178]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Semantic Processing; Arabic Language; Literature, Formalization, Verbs</p>		
27	<p style="text-align: center;"><b>Identification of the Gaseous Zone Origins in Talkhab Area, Markazi Province, Iran</b></p> <p style="text-align: center;">MostafaYousefirad<sup>1</sup>, HamidehNoroozpour<sup>2</sup></p> <p><sup>1</sup>. PhD, Department of Geology, Faculty of Earth Sciences, Payam-e-Noor University, Arak Center, Arak, Iran  <sup>2</sup>. PhD Candidate, Department of Geology, Faculty of Earth Sciences, Science and Research branch, Islamic Azad University (IAU), Tehran, Iran  <a href="mailto:M_Yousefirad@pnu.ac.ir">M_Yousefirad@pnu.ac.ir</a></p> <p><b>Abstract:</b> This paper aims to determine the emission gaseous the Talkhab fault in Farahan (the Iranian village zone locating in (35 Km) north of Arak city). This area is situated at the boundary of the central Iran and Sanandaj–Sirjan zones. A method is described for the analysis of sulphur dioxide, a major contributor to air pollution on absorbing bottle equipped with a fritted glass bubbler. The sample is collected in a dilute solution of H2O2 and analyzed as sulphate. The resultant acid is determined by acid-base titration. Base on chemical and geological studies liberated gas is SO2.This gas liberated by dissolution of litho logic units containing SO42 – ions by groundwater near the Talkhab fault.</p> <p>[MostafaYousefirad, HamidehNoroozpour. Identification of the Gaseous Zone Origins in Talkhab Area, Markazi Province, Iran. Journal of American Science 2011;7(4):179-181]. (ISSN: 1545-1003).  <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Air sampling, Sulphur dioxide, Talkhab, Geology</p>	<a href="#">Full Text</a>	27
28	<p style="text-align: center;"><b>GIS Based Considerations for Development in Different Iranian Climatic Regions</b></p> <p style="text-align: center;">Mortaza Tavakoli<sup>1</sup>, Heshmat-All`ah Mahmoudian<sup>2</sup></p> <p><sup>1</sup>. PhD, Faculty Member, Department of Geography, University of Zabol, Zabol, Iran  <sup>2</sup>. M.Sc. Student, Department of Geography, University of Zabol, Zabol, Iran.  <a href="mailto:Tavakoly52@gmail.com">Tavakoly52@gmail.com</a></p> <p><b>Abstract:</b> In order to develop a climate model for Iran, monthly mean climatic variables from 117 synoptic stations were obtained from the Iranian Meteorological Organization. These variables were reduced to six orthogonal factors using factor analysis. The stations were then divided into six groups using cluster analysis. Within each climatic group, the lowest and highest thresholds for each factor were identified. The factor scores of the stations within each factor were interpolated across the country applying Inverse Squared Distance Weight in the ArcGIS environment. Based on the factor scores, six conditional functions were defined to allocate each pixel to a region. In order to simplify the models, one index variable was substituted for each factor. Then, through Discriminant Analysis, the constants and coefficients of the models were determined. The final models were evaluated against some examples, one of which, Yazd, was demonstrated fully.</p> <p>[Mortaza Tavakoli, Heshmat-All`ah Mahmoudian. GIS Based Considerations for Development in Different Iranian Climatic Regions. Journal of American Science 2011;7(4):182-187]. (ISSN: 1545-1003).  <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> GIS, Climatic Regions Iranian Meteorological Organization, ArcGIS</p>	<a href="#">Full Text</a>	28



29	<p style="text-align: center;"><b>Assessing Relationship between micro-credit and empowerment of rural women</b></p> <p style="text-align: center;"><sup>1</sup>Ali Badragheh, <sup>2</sup>Mohammad Abedi</p> <p style="text-align: center;"><sup>1,2</sup> Department of Agricultural Economic, Islamic Azad University, Marvdasht Branch, Marvdasht, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> rural woman helps to prepare farm , then she plows , harvests , does weeding and transplants , does milking and also acts as shepherd , weaves carpet , tries to make tools and handicrafts , bakes bread , cooks , does housekeeping duties , fetches water from water sources and from distances , fetches firewood , cares children , spins wool and makes curd , buttermilk , yogurt , butter and oil . In addition to all these, she is mother and family supervisor too. In spite of that rural women in developing countries are producer of about 80% of foods and responsible of supervising of about 30% of rural families, but their activities wasn't considered as economic activity and simply are removed from agriculture and rural development programs. Base on formal existing statistics, women form about 31% of agriculture active workforce in developing countries. While, informal and local statistics, estimate number of working women at agriculture part more than formal statistics. In Egypt, base on formal statistic, rural women's activity has been reported about 36 % . While local statistic represents between 35 to 50%. Base on formal statistic at many African countries (e.g. Congo) women's share at preparing labor workforce at agriculture part is 60% but base on informal statistics, above share is reported 80%. This statistical difference exists at most developing countries. In addition to aforementioned substances, it is possible to mention women's share of active force at agriculture part as follow.</p> <p>[Ali Badragheh and Mohammad Abedi. <b>Assessing Relationship between micro-credit and empowerment of rural women.</b> Journal of American Science 2011;7(4):188-193]. (ISSN: 1545-1003).  <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> empowerment, rural women, micro-credit</p>	<a href="#">Full Text</a>	29
30	<p style="text-align: center;"><b>Different aspects of empowerment of rural women in developing countries</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh</p> <p style="text-align: center;"><sup>1,2</sup> Department of Agricultural Economic, Islamic Azad University, Marvdasht Branch, Marvdasht, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> One of the raised strategy , in order to accelerate investment process and reinforcing financial foundations , and saving , at deprived and rural areas , has been empowering and eradicating poverty of rural societies through efficiency with emphasize on applying micro-credits .Micro-loans as useful tool to fight against poverty and starvation, has proven its capabilities and values to develop these areas. These tools have ability to change and improve human's life, especially poor peoples. Micro loans , saving accounts , and giving various bank services , cause this belief in low income and poor family that , by accessing to these services , their income will increase ,so they can protect themselves against barriers of unexpected problems and their current level of life and also invest on nutrition , housing and their children's education.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>Different aspects of empowerment of rural women in developing countries.</b> Journal of American Science 2011;7(4):194-199]. (ISSN: 1545-1003).  <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> empowerment, rural women, developing countries</p>	<a href="#">Full Text</a>	30
31	<p style="text-align: center;"><b>Empowerment of rural women: recommendations for developing countries</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh</p> <p style="text-align: center;"><sup>1,2</sup> Department of Agricultural Extension and Education, Varamin Branch, Islamic Azad University, Varamin, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> However rural women play major role to produce food at all over the world, but rarely enjoy of extension services. Wherever, rural women as producers of food productions and family supervisor, have little contact with extension services organizations, so their problems and needs would reflect at extensional information feedback, rarely. Therefore agricultural research institutions wouldn't be able to create and develop technology,</p>	<a href="#">Full Text</a>	31

	<p>suitable for their needs. Global surveys show that about 5% of total extension resources, at all over the world dedicated to programs for female farmers, but women form just 15% of extension personnel of world. Some extensional issues that traditionally belong to women, such as economy of family, are supported very little that receive just about 1% of total extension resources of agriculture.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>Empowerment of rural women: recommendations for developing countries</b>. Journal of American Science 2011;7(4):200-204]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> empowerment, rural women, developing countries</p>		
32	<p style="text-align: center;"><b>Financial support of rural women: an approach toward their empowerment</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh  <sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran  *Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> Global researches show that women played critical and important role at agriculture and now at most countries, they form major workforce of this part. In spite of importance of women workforce at different systems of agriculture, they have fewer access to development resources, compare to men. although during past two decades , various programs has been performed to enable women at agriculture , but due to different problems , gained success was very fewer than required extent . One of major problem in this filed is inadequate and inappropriate access to extensional services. Low efficiency of agriculture extension systems to provide services for rural women doesn't just refer to structure and function of these organizations and systems, but refer to other issues including research and cultural barriers in this field. However, one of essential needs to extend agriculture is, determining appropriate ways and approaches to educate women at every region or country. at many past decades , significant global efforts were done to provide educating how to access information , appropriate and effective technology for female farmers that led to positive effects on producing agricultural crops and consequently increasing family welfare.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>Financial support of rural women: an approach toward their empowerment</b>. Journal of American Science 2011;7(4):205-211]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> empowerment, rural women, financial support</p>	<a href="#">Full Text</a>	32
33	<p style="text-align: center;"><b>Programs for empowering rural women in Iran</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh  <sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran  *Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> In micro-credits programs other than offering and distributing micro loans, there are also small savings and deposits so that they are designed as form of saving-credit programs. The existing term in phrase “micro-credits” points to two basic concepts that is due to dominant perspective on this approach. First term (i.e. credits) points to rural areas and lack of access for many villagers to formal resources that are one of their major problems. And at system of micro-credits, are tried to decrease poor families' access barriers to credit sources and also to increase effectiveness of these markets. Second term (i.e. micro) emphasize on deficiency of development, according to classic economist’s method. Emphasizing on concept of “micro” means revising recommendations of market economy at rural society's development.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>Programs for empowering rural women in Iran</b>. Journal of American Science 2011;7(4):212-216]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Empowerment, Rural Women, IRAN</p>	<a href="#">Full Text</a>	33
34	<p style="text-align: center;"><b>Improving performance and some metabolic response by using some antioxidants in laying diets during summer season.</b></p> <p style="text-align: center;">El-Mallah, G.M.<sup>1</sup>; Yassein, S.A.<sup>1</sup>; Magda, M. Abdel-Fattah<sup>2</sup> and El-Ghamry, A.A.<sup>1</sup></p> <p style="text-align: center;"><sup>1</sup>Department of Animal production, National Research Center,Dokki,Egypt.  <sup>2</sup>Department of Poultry Nutrition Res. Animal Prod. Res. Inst. Agric. Res. Center, Dokki, Giza.</p>	<a href="#">Full Text</a>	34



	<p><b>Abstract:</b> The present work was conducted to define the effect of adding vitamin E (Vit. E) and/or selenium as seleno-yeast (SY) on performance, egg quality and some blood constituents of laying hens during summer months. Two hundred seventy Hi- sex Brown layers in their 25 weeks of age were randomly divided into nine dietary treatment groups. Each treatment included thirty hens in 6 replicates (5 birds/each). The obtained results showed that dietary Vit.E at either level 0.20 or 0.40mg/kg considerably resulted in positive significant effect on egg production (EP) values and had no effect on egg weight (EW) compared to the control. Also, feed intake (FI) did not differ while, feed conversion (FC) values were improved due to Vit.E addition compared to the control. However, dietary organic se (SY) achieved significant increase on EP values but no differences on EW and FI values, while FC achieved the best values by adding SY as compared to the control. Both levels of Vit.E significantly improved shell-thickness and decreased shape index and yolk color than the control, whereas, no effects were observed on egg quality parameters due to SY addition, except, yolk index which improved compared to the control. On the other hand, plasma total protein (TP), albumin (Alb) and globulin (GLO) were significantly increased by adding Vit.E but AST, ALT and glutathione peroxidase were not affected versus to SY addition which caused significant effects on ALT and glutathione peroxidase and increased with the higher level of SY. There were significant interactions due to Vit.E x SY addition concerning the performance (EP, EW, FI and FC), most egg quality parameters (shape index, Haugh units and yolk index) and some blood plasma (TP, Alb, Glo. and glutathione peroxidase) to laying hens diets. So, it could be recommended that adding either Vit. E and/or selenium enriched yeast (SY) as antioxidants were found to be effective on improving laying performance and could be beneficial during the summer season.</p> <p>[El-Mallah, G.M.; Yassein, S.A.; Magda, M. Abdel-Fattah and El-Ghamry, A.A. <b>Improving performance and some metabolic response by using some antioxidants in laying diets during summer season.</b> Journal of American Science 2011;7(4):217-224]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Improving performance, Blood metabolic, laying diets, summer season.</p>		
35	<p style="text-align: center;"><b>Assessing characteristics of Online Education and comparing of Traditional Education</b>  <sup>1</sup>Ali Badragheh, <sup>2</sup>Mohammad Abedi  <sup>1, 2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran  *Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> Distance education dictates changes in behavior for both the teacher and the learner. The successful student develops persistence and skills in self-directing work. The successful distance education teacher becomes conversant with new technology and develops new instructional styles, moving from creating instruction to managing resources and students and disseminating views. Administrative and faculty support for distance education are critical to the success of this instructional method. Administrators should take note that the implementation of a distance education program may allow access to a greater number of students. However, the time and work associated with teaching at a distance exceeds the normal requirements of campus-based instruction. Students in distance education settings perform as well or better on assignments, class activities, and exams when compared to campus-based students. Nevertheless, students must maintain persistence and a clear focus to succeed in a distance learning situation. Self-direction, a passion for learning, and strong individual responsibility are important influences on achievement. There are indications that distance education works best for more mature, motivated, well-organized, and already accomplished learners .</p> <p>[Ali Badragheh and Mohammad Abedi. <b>Assessing characteristics of Online Education and comparing of Traditional Education.</b> Journal of American Science 2011;7(4):225-230]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Online Education, Traditional Education</p>	<a href="#">Full Text</a>	35
36	<p style="text-align: center;"><b>Assessing Different methods used in distance education</b>  <sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi  <sup>1, 2</sup> Department of Agricultural Extension and Education, Varamin Branch, Islamic Azad University, Varamin, Iran  *Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> In the earlier days of distance learning, it was most common to see distance learning used for rural students who were at a distance from an educational institution. The student might watch a telecourse on a</p>	<a href="#">Full Text</a>	36

	<p>television stations, read texts, mail in assignments and then travel to the local college to take an exam. This model is still in use, but as the technology has become more sophisticated and the cost of distance learning dropped as equipment prices dropped, the use of distance education has increased. High front-end costs prevented an early widespread adoption of electronically mediated learning. Distance learning has been aggressively adopted in many areas because it can meet specific educational needs. As the concept of accountability became accepted and laws required certain courses in high school in order for students to be admitted to state colleges, telecommunications was examined as a way to provide student access to the required courses. Many rural school districts could not afford the special teachers to conduct required courses. Distance education met this need by providing courses in schools where teachers were not available or were too costly to provide for a few students. It also fulfilled a need for teacher training and staff development in locations where experts and resources were difficult to obtain. These systems link learner communities with each other and bring a wide array of experts and information to the classroom.</p> <p>[Ali Badragheh and Mohammad Abedi. <b>Assessing Different methods used in distance education</b>. Journal of American Science 2011;7(4):231-236]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> distance education, educational methods</p>		
37	<p style="text-align: center;"><b>Characterization of Online Degrees and comparing with Traditional Degrees</b>  <sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh  <sup>1, 2</sup> Department of Agricultural Extension and Education, Varamin Branch, Islamic Azad University,  Varamin, Iran  *Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> Technology transports information, not people. Distances between teachers and students are bridged with an array of familiar technology as well as new information age equipment. What sets today's distance education efforts apart from previous efforts is the possibility of an interactive capacity that provides learner and teacher with needed feedback, including the opportunity to dialogue, clarify, or assess. Advances in digital compression technology may greatly expand the number of channels that can be sent over any transmission medium, doubling or even tripling channel capacity. Technologies for learning at a distance are also enlarging our definition of how students learn, where they learn, and who teaches them. No one technology is best for all situations and applications. Different technologies have different capabilities and limitations, and effective implementation will depend on matching technological capabilities to education needs.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>Characterization of Online Degrees and comparing with Traditional Degrees</b>. Journal of American Science 2011;7(4):237-242]. (ISSN: 1545-1003).  <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Online Degrees and, Traditional Degrees, distance education</p>	<a href="#">Full Text</a>	37
38	<p style="text-align: center;"><b>Effects of black tea in mitigation of sodium fluoride potency to suppress motor activity and coordination in laboratory rats</b></p> <p style="text-align: center;">Heba S. El-lethey, Mervat M. Kamel*</p> <p>Department of Animal Hygiene and Management, Faculty of veterinary Medicine, Cairo University, Cairo, Egypt  <a href="mailto:mevy58@yahoo.com">mevy58@yahoo.com</a></p> <p><b>Abstract:</b> The present study was designed to assess the potential impact of Na-F alone or in conjugation with black tea on motor function and coordination performance in laboratory rats. An array of behavioural motor tasks, viz., open field, plank walking and rod walking tests were employed in our study in order to evaluate animals' motor health. Body weight gain as a performance criterion was also monitored. Eighty weanling 32-days old Wistar male rats randomly allotted to four groups of 20 animals each, were administered Na-F at 100 ppm and 2% black tea for a period of twelve weeks in a factorial pattern to constitute 4 experimental treatments. Black tea significantly improved Na-F-induced marked losses in body weight gains of rats. In the open field test, Na-F-treated rats displayed no significant changes in the levels of motor activities (horizontal locomotion) compared to control. However, fluorotic animals performed poorly in all studied motor-coordination tests. Administration of black tea to Na-F-exposed rats also significantly enhanced their motor performance and coordination ability during psychomotor testing. Concerning animals' walking pattern, high incidence of shaky movements with unsteady gait was markedly observed in Na-F-intoxicated rats, as compared to control, confirms lacking of muscle tone and</p>	<a href="#">Full Text</a>	38

	<p>coordination. Our findings illustrate that black tea affords a profound protection against fluoride intoxication-provoked harmful effects on motor health as signified by inhibited motor activities accompanied by poor coordination proficiency in laboratory rats, and hearten to recommend for simultaneous supplementation of black tea to Na-F-jeopardized individuals in order to help mitigate fluorosis-inflicted hazards.</p> <p>[Heba S. El-Iethy, Mervat M. Kamel. <b>Effects of black tea in mitigation of sodium fluoride potency to suppress motor activity and coordination in laboratory rats.</b> Journal of American Science 2011;7(4):243-254]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Sodium fluoride, skeletal fluorosis, black tea, motor activity, coordination, psychomotor testing, body weight gain</p>		
39	<p><b>Factors Influencing Commercialization of Nano and Biotechnologies in Agriculture Sector of Iran</b></p> <p>Seyed Jamal Hosseini <sup>1</sup>, Bahreh Ansari <sup>2</sup>, Somaeih Esmaeeli <sup>2</sup></p> <p><sup>1</sup>. Department of Agricultural Extension and Education, Science and Research Branch, Islamic Azad University, Tehran, Iran jamalfhosseini@srbiau.ac.ir</p> <p><sup>2</sup>. Department of Agricultural Development, Botany, Science and Research Branch, Islamic Azad University, Tehran, Iran</p> <p><b>Abstract:</b> Faculty members and researchers in Agricultural Biotechnology Research Center in Iran were surveyed in order to explore their perception about the factors influencing the commercialization of nano and biotechnologies in agricultural sector. The data was analyzed by using ordinal factor analysis technique. Based on the perception of the respondents and ordinal factor analysis, factors were categorized into seven groups, namely infrastructural, production, management, economic, research.</p> <p>[Seyed Jamal Hosseini, Bahreh Ansari, Somaeih Esmaeeli. Factors Influencing the Commercialization of Nano and Biotechnologies in Agriculture Sector of Iran. Journal of American Science 2011;7(4):255-258]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Nanotechnology; biotechnology; commercialization; Iran</p>	<a href="#">Full Text</a>	39
40	<p><b>Ordinal Factor Analysis of Constraints in Iran's Sustainable Agricultural Development (Case Study: Greenhouse Production)</b></p> <p>Seyed Jamal Hosseini <sup>1</sup>, Floria Mohammadi <sup>2</sup>, Seyed Mehdi Mirdammadi <sup>2</sup></p> <p><sup>1</sup>. Department of Agricultural Extension and Education, Science and Research Branch, Islamic Azad University, Tehran,Iran</p> <p><sup>2</sup>. Department of Agricultural Development, Science and Research Branch, Islamic Azad University, Tehran,Iran <a href="mailto:jamalfhosseini@srbiau.ac.ir">jamalfhosseini@srbiau.ac.ir</a></p> <p><b>Abstract:</b> Greenhouse Owners in the Province of Tehran were surveyed in order to explore their perception about the constraints in developing sustainable agriculture. The methodology used in this study involved a combination of descriptive and quantitative research. The total population was 306 greenhouse owners in the Province of Tehran. As the ordinal factor analysis showed, the constraints were categorized into four groups, namely economic, social, regulatory and technical, ordered by the magnitude of their impact.</p> <p>[Seyed Jamal Hosseini, Floria Mohammadi, Seyed Mehdi Mirdammadi. Ordinal Factor Analysis of Constraints in Iran's Sustainable Agricultural Development (Case Study: Greenhouse Production). Journal of American Science 2011;7(4):259-163]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Sustainable agriculture; greenhouse; Iran; Tehran</p>	<a href="#">Full Text</a>	40
41	<p><b>Effect of Lactic Acid Bacteria against Heavy Metals Toxicity in Rats</b></p> <p><sup>1</sup>Abou-Baker Salim, <sup>2</sup>Ibrahim H. Badawy and <sup>2</sup>Seham S. Kassem</p>	<a href="#">Full Text</a>	41

	<p><sup>1</sup>Food Toxicology and Contaminants Department, National Research Center, Cairo, Egypt  <sup>2</sup>Nutrition Department, National Research Center, Cairo, Egypt  <a href="mailto:salimali740@hotmail.com">salimali740@hotmail.com</a></p> <p><b>Abstract:</b> Cadmium and lead are highly toxic metals; people are exposed to them primarily through food and water. Therefore the study aimed to estimate the effect of lactic acid bacteria against toxicity induced by contaminated diet with lead and cadmium mixture in rats. Forty two Albino male rats (Sprague Dowely strain) of an average weight <math>130 \pm 10</math> g were divided into 6 groups each group contains 7 rats. G1: fed on basal diet (negative control); G2: fed on contaminated food with 0.025mg lead acetate/kg diet + 0.025mg cadmium chloride /kg diet (positive control); G3: fed on basal diet supplemented with strain 1 of lactic acid bacteria (<i>Streptococcus thermophilus</i>); G4: fed on basal diet supplemented with strain 2 of lactic acid bacteria (<i>Lactobacillus bulgaricus</i>). The other two groups received heavy metals contaminated diet supplemented with strain1and strain2 lactic acid bacteria for 6 weeks. The results revealed that positive control gave a highly significant increased in liver functions (alanine aminotransferase (ALT) and aspartate minotransferase (AST) activities), kidney functions (creatinine and urea); significantly decreased in glutathione peroxidase (GPX), blood hemoglobin, body weight and feed efficiency ratio. However lactic acid strains supplemented to heavy metals treated group significantly improved the in glutathione peroxydase, blood hemoglobin, body weight and feed efficiency ratio and the elevation of ALT, AST, creatinine and urea. The results also showed that the group received basal diet supplemented with strain 1 (<i>Streptococcus thermophilus</i>) and strain 2 (<i>Lactobacillus bulgaricus</i>) has beneficial health effects on animals. It was noticed that the group received strain 1 (<i>Streptococcus thermophilus</i>) showed better results than strain 2 (<i>Lactobacillus bulgaricus</i>). The results of histopathology obtained also indicate that tested lactic acid bacteria strains have an effective role against the toxicity induced by lead and cadmium. These results indicated the potential protective action of tested lactic acid strains against lead and cadmium toxicity as well as their beneficial health effects. This may be due the ability of lactic acid strains to bind heavy metals, the DNA protective effect of LAB and thought to have several presumably beneficial effects on immune function. In addition LAB decreased the amount of administered carcinogens reaching the blood.  [Abou-Baker Salim, Ibrahim H. Badawy and Seham S. Kassem. Effect of Lactic Acid Bacteria against Heavy Metals Toxicity in Rats. Journal of American Science 2011;7(4):264-274]. (ISSN: 1545-1003).  <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key Words:</b> lactic acid bacteria, Heavy Metals, lead, cadmium</p>		
42	<p><b>Deterioration of Rock Art Painting at unfinished obelisk quarry in Aswan</b></p> <p><b>Shehata Ahmed Abdel Rahim <sup>*1</sup> and Hesham Abbas Kamally<sup>2</sup></b></p> <p><sup>1</sup>Conservation and Restoration Department, Faculty of Archeology, FayoumUniversity, Egypt  <sup>2</sup>Restoration Department, High Institute of Tourism, Hotel Management and Restoration, Alexandria, Egypt  <sup>*</sup><a href="mailto:shehataaa@yahoo.com">shehataaa@yahoo.com</a></p> <p><b>Abstract:</b> The famous unfinished obelisk quarry, southeast of Aswan is a unique source of large granite monuments. The area of the northern obelisk quarry has been recently excavated and renovated by Supreme Council of Antiquities, a huge mounds of rubble, sand and granite powder cleared to reveal many unknown granite objects, unfinished statues and several quarry tools. After the workers cleaning the sand and dirt from the quarry walls, they found that the quarry faces covered with striking scenes. The first feature, a group of Ostriches, different in body size walking in the desert with red ochre. The second feature fishes swimming in water have fins and use gills for breathing underwater and several boats or cargo boats with black ochre. Moreover, a large obelisk with red ochre present between the swimming fishes distinctly different in body size. The present paper is an attempt to elucidate the weathering, geological and structural characteristics of granite rocks. This paper also aims to identify and understand the causes and mechanisms of deterioration of the wall paintings in the unfinished obelisk quarry. Exposure to wind, rain, fluctuation of temperature, groundwater, seepage, moisture, biological growth and encrustation, all contribute to the deterioration of the rock art in the quarry. Salt effloresces, granular disintegration and the enlargement of existing granite pores and cracks close to the rock surface, facilitate and accelerating the rate of weathering. Unfortunately, even slow rates of weathering can lead to unacceptable deterioration of rock paintings, as the painting layer on the granite surface are friable and cannot persist on a</p>	<a href="#">Full Text</a>	42

	<p>disaggregating or flaking granite surfaces. Several samples has been examined by petrographic microscope, X- ray diffraction analysis (XRD) and scanning electron microscope (SEM) showed that the products of the highly weathered pink granite are dominated by kaolinite, iron oxides, calcite and muscovite.</p> <p>[Shehata Ahmed Abdel Rahim and Hesham Abbas Kamally. <b>Deterioration of Rock Art Painting at unfinished obelisk quarry in Aswan</b>. Journal of American Science 2011;7(4):275-281]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words</b> Rock painting, granite weathering, unfinished obelisk quarry, red painting, black painting</p>		
43	<p><b>Study Of Peripheral Neuropathy In Chronic Hepatitis C Virus Infected Patients</b></p> <p>Atef Abo AL-Soud, Ayman ELlehleh, *Rasha El-Kapany, Heba El-Hagary</p> <p>Department of Tropical medicine and *Department of Neurology, Minoufiya University, Egypt.</p> <p><b>Abstract: Background:</b>Hepatitis C is a serious worldwide problem, the WHO has estimated that, 170 million people worldwide are infected with hepatitis, while the prevalence in the general population ranges between 0.2 and 2%. <b>Aim of the work:</b> to study peripheral neuropathy in patients with chronic hepatitis C virus infection. <b>Patients and methods:</b> This study was conducted on forty patients selected from patients Of Tropical Medicine Department in Minoufiya University Hospital suffering from chronic hepatitis C virus infection. They were 23males and 17 females and their ages were ranging from 28 to 62 years, plus twenty healthy persons of matched age and sex. These patients will be classified into 3 groups:Group (1): Chronic HCV patients without liver cirrhosis, group (2): Chronic HCV patients with liver cirrhosis and group(3):Persons matching for age and sex as a control group. All Patients and control group will be subjected to Thorough history taking, Full clinical examination, Neurological examination, Laboratory investigations: Complete blood count, liver function tests, kidney function tests, random blood glucose level, Viral markers by ELISA, estimation of serum level of vitamin B12, estimation of serum level of cryoglobulins (immunoglobulin (Ig M)) and complement (C3), abdominal ultrasonography and nerve conduction studies. <b>Results:</b> peripheral neuropathy was diagnosed by electrophysiological examination in 14 patients (35%) of HCV positive cases and clinical peripheral neuropathy presented in 10 patients (25%). There is significant decrease of the amplitude of the median, ulnar and peroneal nerves in the group of HCV patients with cirrhosis than the control group but not between patients without cirrhosis and the cirrhotic or the control group. Also there was no statistically significant difference between the three studied groups as regard to the conduction velocity and distal latency of median, ulnar and peroneal nerves. Significant increase in serum cryoglobulin in peripheral neuropathy patients as 10 (71.43%) patients having peripheral neuropathy are positive CG. <b>Conclusion:</b> PN is present in HCV patients without cirrhosis and become progressively increased in HCV patients with cirrhosis, PN in HCV patients is polyneuropathy and axonal. PN may be clinically diagnosed or diagnosed by electrophysiological examination, Cryoglobulins significantly increased in HCV patients with peripheral neuropathy.</p> <p>[Atef Abo AL-Soud, Ayman ELlehleh, Rasha El-Kapany, Heba El-Hagary. <b>Study Of Peripheral Neuropathy In Chronic Hepatitis C Virus Infected Patients</b>. Journal of American Science 2011;7(4):282-288]. (ISSN: 154-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords :</b> HCV , Cryoglobulin and peripheral neuropathy.</p>	<a href="#">Full Text</a>	43
44	<p><b>Distance Education in Agricultural Education</b></p> <p><sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi</p> <p><sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran</p> <p>*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home. The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed</p>	<a href="#">Full Text</a>	44



	<p>video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.</p> <p>[Ali Badragheh and Mohammad Abedi. <b>Distance Education in Agricultural Education</b>. Journal of American Science. 2011;7(4):289-294]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Distance Education, Agricultural Education</p>		
45	<p style="text-align: center;"><b>Distance Education in Developing Countries</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh</p> <p style="text-align: center;"><sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> Distance education is a method of education in which the learner is physically separated from the teacher and the institution sponsoring the instruction. It may be used on its own, or in conjunction with other forms of education, including face-to-face instruction. In any distance education process there must be a teacher, one or more students, and a course or curriculum that the teacher is capable of teaching and the student is trying to learn. The contract between teacher and learner, whether in a traditional classroom or distance education, requires that the student be taught, assessed, given guidance and, where appropriate, prepared for examinations that may or may not be conducted by the institution. This must be accomplished by two-way communication. Learning may be undertaken either individually or in groups; in either case, it is accomplished in the physical absence of the teacher in distance education. Where distance teaching materials are provided to learners, they are structured in ways that facilitate learning at a distance.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>Distance Education in Developing Countries</b>. Journal of American Science 2011;7(4):295-301]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Distance Education, Developing Countries</p>	<a href="#">Full Text</a>	45
46	<p style="text-align: center;"><b>Distance Learning: definitions and applications</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh</p> <p style="text-align: center;"><sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology. Courses are offered in gemology, high school diploma, journalism, lock smiting, child day care management, yacht design, and many fascinating subjects. Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>Distance Learning: definitions and applications</b>. Journal of American Science 2011;7(4):302-306]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Distance Learning, Distance education</p>	<a href="#">Full Text</a>	46
47	<p style="text-align: center;"><b>Online Classes VS Traditional Classes: Comparison between the Two Methods</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh</p> <p style="text-align: center;"><sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> There are two types of programs offered by distance education schools: synchronous learning programs and asynchronous learning programs. With synchronous learning, distance education students must log on to the school's website at a set time. Often, they interact with their peers and professors via group chats, web seminars, video conferencing, and phone call-ins. With asynchronous learning, distance education students complete all coursework on their own time. They often learn via assignment sheets, message boards, email, pre-recorded video lectures, mp3s, and traditional mail correspondence.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>Online Classes VS Traditional Classes: Comparison between the Two</b></p>	<a href="#">Full Text</a>	47

	<p><b>Methods.</b> Journal of American Science 2011;7(4):307-314]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Online Classes, Traditional Classes, distance education</p>		
48	<p style="text-align: center;"><b>The role of ICT in distance education</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh</p> <p style="text-align: center;"><sup>1, 2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> Challenges which faced the early users of distance education are still with us today. If distance education is to play a greater role in improving the quality of education, it will require expanded technology; more linkages between schools, higher education, and the private sector; and more teachers who use technology well. Teachers must be involved in planning the systems, trained to use the tools they provide, and given the flexibility to revise their teaching. Federal and state regulations will need revision to ensure a more flexible and effective use of technology. Connections have been established across geographic, instructional, and institutional boundaries which provide opportunities for collaboration and resource sharing among many groups In the pooling of students and teachers, distance learning reconfigures the classroom which no longer is bounded by the physical space of the school, district, state or nation.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>The role of ICT in distance education.</b> Journal of American Science. 2011;7(4):315-320]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> ICT, distance education</p>	<a href="#">Full Text</a>	48
49	<p style="text-align: center;"><b>The role of online Learning in improving education</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh</p> <p style="text-align: center;"><sup>1, 2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran</p> <p style="text-align: center;">*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> In its original form, teachers using distance education traveled to remote sites and taught a class, or corresponded with students through mail, telephone, or fax machine. Individualized study has been a method of reaching the remote student for some time. Detailed course instructions are sent to the learner who performs the assigned tasks and returns the completed work to the teacher for evaluation and reassignment if necessary. Technology has raised the quality of individualized distance instruction. The use of various forms of electronic media increases time effectiveness and improves the delivery of information. Video, audio, and computer-based applications may enhance the product received by the independent learner. Electronic delivery can occur using synchronous communication, in which class members participate at the same time, or asynchronous communication where participants are separated by time.</p> <p>[Mohammad Abedi and Ali Badragheh. <b>The role of online Learning in improving education.</b> Journal of American Science 2011;]. (ISSN: 1545-1003).<a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> online Learning, education</p>	<a href="#">Full Text</a>	49
50	<p><b>Unified Scheduling of Pumped-Storage and Hydro-Thermal Units Based on Game Theory</b></p> <p>Mohammad Sadegh Javadi <sup>1</sup>, Bahram Noshad <sup>2</sup>, Azim Nowbakht <sup>3</sup>, Amin Javadinasab <sup>4</sup></p> <p><sup>1</sup>: Islamic Azad University, Mahshahr Branch, Mahshahr, Iran</p> <p><sup>2</sup>: Islamic Azad University, Mahshahr Branch, Mahshahr, Iran</p> <p><sup>3</sup>: Islamic Azad University, Mahshahr Branch, Mahshahr, Iran</p> <p><sup>4</sup>: Islamic Azad University, Shoushtar Branch, Shoushtar, Iran</p> <p><a href="mailto:msjavadi@gmail.com">msjavadi@gmail.com</a></p> <p><b>Abstract:</b> Determining the main strategies in a country is performed with a long-term planning in order to reach sustainable development. Energy category and its delivery have more influence on economic and political development; thus, optimal scheduling should be performed in a way that considers mentioned attribute with comprehensive approach. Energy delivery and its efficiency increase in recent century and considering Next generation needs and their contribution in existing resources are contemplated as a significant challenge. Water is the most important natural resource in the World and it is vital to use these resources in an optimal way because of</p>	<a href="#">Full Text</a>	50



	<p>environmental issues and also political, economic, social issues, etc. One way to control and rein of surface water is to build dams on rivers. The dams are built for various reasons, but most serve multiple purposes: flood control power generation, irrigation, diversion, pisciculture, urban water reservoirs, livestock watering, and etc. The electric energy generation in majority of enormous dams is considered as a green power source with high efficiency. This paper introduces a new approach in order to control the existing fountains using pumped-storage systems based on game theory.</p> <p>[Mohammad Sadegh Javadi, Bahram Noshad, Azim Nowbakht, Amin Javadinasab. Unified Scheduling of Pumped-Storage and Hydro-Thermal Units Based on Game Theory. Journal of American Science 2011;7(4):327-335]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Energy Market, Cournot Model, Game Theory, Pumped-storage Unit</p>		
51	<p>Effect of cobalt, and nitrogen forms on nitrate accumulation in Jew's mallow plant as affected by a nitrification inhibitor (N-serve)</p> <p>Safaa, A. Mahmoud; Abd-Elfattah, M.S; Khaled. S.M and Hanan.S. Siam</p> <p>Plant Nutrition Department. National Research Centre. Dokki – Cairo – Egypt. drhanansiam@yahoo.com</p> <p><b>Abstract:</b> A pot experiment was established in the green house of National Research Centre to evaluate the effect addition of cobalt element at a rate 10 ppm, different rates of nitrogen (100 and 200) ppm N and forms of nitrogen as a Sodium Nitrate Na NO<sub>3</sub>, Ammonium Sulphate (NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub> and Urea (NH<sub>2</sub>)<sub>2</sub> CO as others two treatments with and / or without a nitrification inhibitor (N-serve) on mineral composition and nitrate accumulation in Jew's mallow plant in alluvial soil of type clay loam. The results revealed that a positive contact was found between nitrogen rates and each of fresh, dry weight and plant contents of Cobalt, Nitrogen, Phosphorus, Potassium, Nitrate and residual effect of inorganic Nitrogen. While, a negative relation with trace elements contents (Fe, Mn, Zn and Cu) was observed Treatments of ( Ammonium sulphate and Urea) with Cobalt and (N-serve) as a nitrification inhibitor registered the highest value of all the determinations studied, except a nitrate accumulation in plant which recorded the highest values with (Sodium Nitrate, Ammonium Sulphate and Urea ) with cobalt and without inhibitor respectively. Residual effect of inorganic nitrogen registered the highest values with (ammonium sulphate and urea) treatments with cobalt and (N-serve) inhibitor respectively. Results concluded that.</p> <p>[Safaa, A. Mahmoud; Abd-Elfattah, M.S; Khaled. S.M and Hanan.S. Siam. Effect of cobalt, and nitrogen forms on nitrate accumulation in Jew's mallow plant as affected by a nitrification inhibitor (N-serve). Journal of American Science 2011;7(4):336-348]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Nitrogen – Cobalt – (N-serve) inhibitor – Nitrate accumulation – Jew's mallow-clayloam soil.</p>	<a href="#">Full Text</a>	51
52	<p><b>The Efficacy of Immediate and Delayed Corrective Feedback in the Correct Use of English Definite and Indefinite Articles</b></p> <p>Afshin Soori <sup>1</sup>, Arshad Abd. Samad <sup>2</sup></p> <p><sup>1</sup>. Faculty member, Department of English Language and Literature, Islamic Azad University, Larestan Branch, Iran</p> <p><sup>1</sup>. Associate Professor, Department of Language and Humanities Education, Faculty of Educational Studies, Universiti Putra Malaysia, UPM Serdang, Selangor D.E. Malaysia <a href="mailto:Arshad@educ.upm.edu.my">Arshad@educ.upm.edu.my</a></p> <p><b>Abstract:</b> The process of giving effective feedback is a central concern for teachers and researchers in both first language and second language writing. Many teachers correct students' written errors in the hope that this will help them improve the students' mastery over the correct use of targeted linguistic forms, while Truscott (1996) considered this approach as a misguided endeavour due to his claim that feedback on grammar errors had no place in writing classrooms and it should be abandoned. Regarding this issue, the current study investigated the results of nine weeks treatment on the efficacy of immediate and delayed corrective feedback in the correct use of definite and indefinite articles. Data were collected from a sample of 51 (34 males and 17 females) first year Iranian EFL</p>	<a href="#">Full Text</a>	52

	<p>medical students. The students were administered three rational cloze tests (pre-test, immediate post-test, and delayed post-test). The finding of the study revealed that immediate corrective feedback had a significant effect on the correct use of English articles and the students received corrective feedback significantly improved their ability in using English article system correctly and that they retained this ability when they were given a new test four weeks after the treatment session. This study also indicated that there was a change in article scores across the three different time periods. Thus, the main effect for time was significant.</p> <p>[Afshin Soori, Arshad Abd. Samad. The Efficacy of Immediate and Delayed Corrective Feedback in the Correct Use of English Definite and Indefinite Articles. Journal of American Science 2011;7(4):349-354]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Corrective feedback; Error correction; Definite and indefinite articles</p>		
53	<p><b>Species compositions and relative abundance of insect pest associated with some stored cereal grains in selected markets of Maiduguri metropolitan.</b></p> <p>Chimoya I. A. <sup>1</sup> and Abdullahi G. <sup>2</sup></p> <p><sup>1</sup>Department of Agricultural Technology, Federal polytechnic P.M.B, 35, Mubi Adamawa State –Nigeria.  <sup>2</sup>Department of Crop Science, Adamawa State University, P.M.B. 25, Mubi, Adamawa State Nigeria.  gatsaranyi@yahoo.com</p> <p><b>Abstract:</b> A survey was conducted from November 2005 to 2006 to determine the species composition and frequency of occurrence of insect pests associated with stored cereal grains in some selected markets in Maiduguri metropolis Borno state- Nigeria. Random sampling methods were used in selecting traders in the markets for the survey. Samples of 1kg of maize, Millet, Sorghum and rice were taken from the stock with the traders for analysis and insect infestation determination. Insect species identified with the grains and their relative abundance in percentages are; <i>Tribolium castaneum</i> Herbst 30.9%, <i>Sitophilus</i> spp 27.4%, <i>Rhizopertha dominica</i> (Fab) 15.2%, <i>Trogoderma granarium</i> (Everts) 11.9% and <i>Cryptolestes</i> spp (Stephens) 14.7%. The result also indicates that <i>T. castaneum</i> and <i>Sitophilus</i> spp were more prevalent. The species preference to different grain types in the order <i>T. castaneum</i> was dominant in maize and Millet; <i>Sitophilus</i> species were dominant in Maize and sorghum, and <i>Rhizopertha dominica</i> being the dominant species in Rice.</p> <p>[Chimoya I. A. and Abdullahi G. <b>Species compositions and relative abundance of insect pest associated with some stored cereal grains in selected markets of Maiduguri metropolitan.</b> Journal of American Science 2011;7(4):355-358]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Species compositions, relative abundance, stored cereals, Maiduguri metropolitan, <i>Tribolium castaneum</i>, <i>Sitophilus</i> spp, <i>Rhizopertha dominica</i>, <i>Trogoderma granarium</i>, <i>Cryptolestes</i> spp</p>	<a href="#">Full Text</a>	53
54	<p><b>Challenges of information and communication technologies (ICT) in rural</b></p> <p><sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi</p> <p><sup>1,2</sup> Department of Agriculture and Natural Resource, Mahabad Branch, Islamic Azad University, Mahabad, Iran</p> <p>*Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> This paper is aimed at the analysis of ICT diffusion in rural communities of Lithuania, exploring the main social patterns of diffusion and characteristics of rural Internet users. The study is based on focus group discussions and questionnaire-based survey of Lithuanian rural residents. There are Fundamental challenges about the role of information and communication technologies (ICT) in education. This has led to serious skills shortages in many countries. In turn this has put increasing pressure on policy makers, universities and other training institutions to come up with approaches to inspire young students to choose ICT for their studies. There is also a strong argument for retraining many people who already have pre-service and in-survive education, whether in the workforce or not, to overcome to looming ICT skills crises. This paper reports on the examination of these points. It will also explore appropriate ways to combat this problem through analysis and identification of real prospects for ICT education.</p> <p>[Ali Badragheh and Mohammad Abedi. <b>Challenges of information and communication technologies (ICT) in</b></p>	<a href="#">Full Text</a>	54

	<p><b>rural</b>. Journal of American Science 2011;7(4):359-362]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.  <b>Keywords:</b> information and communication technologies (ICT), education</p>		
55	<p style="text-align: center;"><b>Participatory rural appraisal (PRA): New method for Rural Research</b></p> <p style="text-align: center;"><sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh  <sup>1,2</sup> Department of Agriculture and Natural Resource, Mahabad Branch, Islamic Azad University,  Mahabad, Iran  *Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> Promising potentials include farmers' own farming systems research, alternatives to questionnaire surveys, monitoring, evaluation and lateral spread by local people, empowerment of the poorer and weaker, and policy review. Changes in personal behavior and attitudes, and in organizational cultures, are implied. PRA parallels and resonates with paradigm shifts in the social and natural sciences, business management, and development thinking, supporting decentralization, local diversity, and personal responsibility. Much of the spread of participatory rural appraisal (PRA) as an emerging family of approaches and methods has been lateral, South-South, through experiential learning and changes in behavior, with different local applications. Rapid spread has made quality assurance a concern, with dangers from "instant fashion", rushing, formalism and ruts. Promising potentials include farmers' own farming systems research, alternatives to questionnaire surveys, monitoring, evaluation and lateral spread by local people, empowerment of the poorer and weaker, and policy review. [Mohammad Abedi and Ali Badragheh. <b>Participatory rural appraisal (PRA): New method for Rural Research</b>. Journal of American Science 2011;7(4):363-368]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.  <b>Keywords:</b> Participatory Rural Appraisal (PRA)</p>	<a href="#">Full Text</a>	55
56	<p style="text-align: center;"><b>Dimensions of Information and Communication Technologies (ICT) diffusion in rural</b></p> <p style="text-align: center;"><sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi  <sup>1,2</sup> Department of Agriculture and Natural Resource, Mahabad Branch, Islamic Azad University,  Mahabad, Iran  *Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> In rural Internet and other information communication technologies (ICT) are mainly used by young, educated, well paid and urban consumers. Elderly, low-educated, low-paid and rural residents are among those who use the Internet the least. This great group consistent with men have had active role at areas of social-economic activities and always have had major part on economic production of society. ICT is now recognized as a technological tool which can serve as a catalytic intervention in respect of transforming the lives and livelihoods of rural families. The economic and income divides between urban and rural areas can be overcome only by the technological upgradation of rural professions. In our post-modern network society they are at the risk of social exclusion. This paper is aimed at the analysis of ICT diffusion in rural communities of Lithuania, exploring the main social patterns of diffusion and characteristics of rural Internet users. The study is based on focus group discussions and questionnaire-based survey of Lithuanian rural residents. The paper discusses types of change agents involved in the processes of ICT diffusion in rural communities and the main motives for using the Internet. [Sharareh Khodamoradi and Mohammad Abedi. <b>Dimensions of Information and Communication Technologies (ICT) diffusion in rural</b>. Journal of American Science 2011;7(4):369-373]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.  <b>Keywords:</b> Information and Communication Technologies (ICT), rural communities, developing countries</p>	<a href="#">Full Text</a>	56
57	<p><b>Damage assessment of buildings due to pipeline settlement using fuzzy decision support tool</b></p> <p>DINA. A. EMARAH<sup>1*</sup>, M. M. HUSSEI<sup>1</sup>, HAMDI. M. MOUSA<sup>2</sup> AND ADEL. Y. AKL<sup>1</sup></p> <p>Structural Engineering Department<sup>1</sup>, Faculty of Engineering, Cairo University,<sup>2</sup> Computer Science Department, Faculty of Computer and Information, Menofia University, Egypt.  <a href="mailto:dina_amarah@yahoo.com">*dina_amarah@yahoo.com</a></p>	<a href="#">Full Text</a>	57

	<p><b>Abstract:</b> Settlement of buildings, due to nearby pipeline deterioration can result in noticeable damage. By combining ground deformation patterns with well-known damage category criteria, the building deformations can be readily assessed without undue oversimplification. In this paper, the well-known computer program ANSYS with geotechnical module “CivilFEM” is used considering nonlinear elastic soil behavior. The finite element model is chosen to investigate the influence of pipeline settlement and burial depth on buildings. Thus, damage category of buildings can be predicted. Also, a fuzzy based assessment system, which evaluates the damage category of buildings was introduced. A criterion to define the membership functions of fuzzy assessment system starting from available information obtained from ANSYS was also described. This results in the prediction of the category of damage of buildings due to the interaction of more than one parameter in pipeline deterioration.</p> <p>[DINA. A. EMARAH, M. M. HUSSEI, HAMD. M. MOUSA AND ADEL. Y. AKL. <b>Damage assessment of buildings due to pipeline settlement using fuzzy decision support tool.</b> Journal of American Science 2011;7(4):374-384]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Damage category, pipeline, settlement, and fuzzy assessment system.</p>		
58	<p><b>Precipitation of Suspended Particles on Tube Walls</b></p> <p>Bedier B. EL-Naggar</p> <p>Department of Engineering Mathematics and Physics, Faculty of Engineering, Cairo University Giza, Egypt <a href="mailto:bbnaggar@hotmail.com">bbnaggar@hotmail.com</a></p> <p><b>Abstract:</b> In this article, the steady state convective diffusion equation for the suspended particles in a suspension is solved for tube flow. Linear concentration drop and uniform axial velocity are assumed. An experiment is designed to measure the concentration at exit and the rate of precipitation on a wall is also measured experimentally after a sufficient time of flow. Accordingly, the diffusion constant is determined and the resulting of area of contraction due to this precipitation is calculated and hence the complete blocking time. This model is suggested for fat precipitation on walls of blood vessels in vivo and the precipitation of salt on walls of water tubes in boilers.</p> <p>[Bedier B. EL-Naggar. <b>Precipitation of Suspended Particles on Tube Walls.</b> Journal of American Science 2011;7(4):385-387]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Precipitation on tube walls, the diffusion coefficient of suspended particles, viscous resistance, Buoyancy neutralizes gravity</p>	<a href="#">Full Text</a>	58
59	<p><b>Profile of Minimum Drag</b></p> <p>Bedier B. EL-Naggar</p> <p>Department of Engineering Mathematics and Physics, Faculty of Engineering, Cairo University Giza, Egypt <a href="mailto:bbnaggar@hotmail.com">bbnaggar@hotmail.com</a></p> <p><b>Abstract:</b> In this paper a variational integral is constructed for the estimation of the coefficient of minimum drag for axial flow over axis-symmetric bodies of revolution. The unknown equation of the profile is determined by writing and solving the corresponding Euler-Lagrange equation. This results in the equation</p> $\frac{y}{c_1} = \frac{\left(1 + \left(\frac{dx}{dy}\right)^2\right)^{\frac{3}{2}}}{-\frac{dx}{dy}} \frac{y}{c_1} = \frac{\left(1 + \left(\frac{dx}{dy}\right)^2\right)^{\frac{3}{2}}}{-\frac{dx}{dy}}$ <p>. This reduces to a cubic equation and the real root is obtained by the method of Cardan. The equation of the curve is then obtained by integration. The integral for the Drag coefficient is computed numerically. The profile <math>y(x)</math> is plotted graphically.</p> <p>[Bedier B. EL-Naggar. <b>Profile of Minimum Drag.</b> Journal of American Science 2011;7(4):388-392]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p>	<a href="#">Full Text</a>	59

	<p><b>Key Words:</b> Minimum Drag, variational integral, axial, axi-symmetric.</p>		
60	<p><b>Stochastic Modeling Compared With Artificial Intelligence Based Approach for Short Term Wind Speed Forecasting</b></p> <p>I. Abd El-Gawad **, M.A. Mustafa Hassan*† , M. A. M. Hallouda*, O.Y. Abul-Haggag*</p> <p>Elec. Power Dept, Faculty of Engineering, Cairo University, Egypt.  *Elec. Power and Machines Dept, Faculty of Engineering, Kafr Elsheikh University, Egypt  † Corresponding E-Mail: <a href="mailto:mmustafa@eng.cu.edu.eg">mmustafa@eng.cu.edu.eg</a></p> <p><b>Abstract:</b> The sophisticated Application of Artificial Intelligent Approaches was introduced recently in renewable energy in electric power systems. However, these approaches started with introducing Fuzzy Logic (FL) in the last decades of the last century. Furthermore, Artificial Neural Network (ANN) was introduced to solve many problems in electric power systems. Among these problems is forecasting of wind speed. In this proposed article, the application of Adaptive Neuro-Fuzzy Inference System (ANFIS) is used to forecast the coming speed of wind using real data of the past. The ANFIS can be viewed as a combination of fuzzy system and neural network or fuzzy neural network. This paper aims; firstly, to forecast the average value of wind speed via some well known method. Secondly compare between these different method like Autoregressive Integrated Moving Average (ARIMA), Autoregressive Moving Average form (ARMA), Autoregressive Form (AR). The goal of these methods is to search for the best one compared to Adaptive Neuro Fuzzy Inference System (ANFIS).  [E .M. Abd El-Gawad, M.A. Mustafa Hassan, M. A. M. Hallouda, O.Y. Abul-Haggag. <b>Stochastic Modeling Compared With Artificial Intelligence Based Approach for Short Term Wind Speed Forecasting</b>. Journal of American Science 2011;7(4):393-399]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Adaptive Neuro Fuzzy Inference System (ANFIS), Autoregressive Integrated Moving Average form (ARIMA), Autoregressive Moving Average form (ARMA), Autoregressive Form (AR), Short-Term Load Forecasting</p>	<p><a href="#">Full Text</a></p>	60
61	<p><b>Stochastic Modelling Compared With Artificial Intelligence Based Approach For Electrical Load Forecasting</b></p> <p>A. Seif E. M. Gabr <sup>1</sup>, M. A. Moustafa Hassan<sup>2*</sup>, O. Y. Abul-Haggag<sup>2</sup></p> <p><sup>1</sup> North Cairo for Electrical Distribution Company (NCED), Ministry of Electricity, Egypt  <sup>2</sup> Electrical Power Department, Faculty of Engineering, Cairo University, Giza, Egypt  *Corresponding e-mail: <a href="mailto:mmustafa_98@hotmail.com">mmustafa_98@hotmail.com</a></p> <p><b>Abstract:</b> Accurate load forecasting is very important for electric utilities in planning for new plants. Also it is very significant for the routine of maintaining, scheduling daily, electrical generation, and loads. In this study, emphasis was considered on short-term load forecasting which is important for real time operation and control of power systems. Artificial intelligence and stochastic forecasting models were examined. The performance of these models is dependent on the characteristics of electric loads and is based on the assumption that electric load patterns are basically invariant with time. Two different models were considered and a new stochastic model (called REGARIMA) was introduced and compared with ANFIS model. Both models were tested and shown to be the best one that represents the available data. The results obtained using the two approaches are very accurate and mutually competitive. Furthermore, they are very promising in short term forecasting techniques, which could be applied as well on wind speed forecasting.  [A. Seif E. M. Gabr, M. A. Moustafa Hassan, O. Y. Abul-Haggag. <b>Stochastic Modelling Compared With Artificial Intelligence Based Approach For Electrical Load Forecasting</b>. Journal of American Science 2011;7(4):400-407]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Artificial Intelligence Techniques, Short Term Forecasting, Peak Loads, Stochastic Forecasting Models, ARIMA Models, Adaptive Neuro Fuzzy Inference Systems (ANFIS).</p>	<p><a href="#">Full Text</a></p>	61



62	<p style="text-align: center;"><b>Distance Education: definitions and applications</b></p> <p style="text-align: center;">Ali Badragheh</p> <p style="text-align: center;">Department of Agricultural Extension Education, Islamic Azad University, Garmsar Branch, Garmsar, Iran</p> <p style="text-align: center;">*Corresponding author: badraghehali@yahoo.com</p> <p><b>Abstract:</b> Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-instructor relationship, which is the hallmark of distance education instruction.</p> <p>[Ali Badragheh. <b>Distance Education: definitions and applications.</b> Journal of American Science 2011;7(4):408-414]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Distance Education, E-learning</p>	<a href="#">Full Text</a>	62
63	<p style="text-align: center;"><b>Assessing Similarities and differences between Distance Education and e-learning</b></p> <p style="text-align: center;">Ali Badragheh</p> <p style="text-align: center;">Department of Agricultural Extension Education, Islamic Azad University, Garmsar Branch, Garmsar, Iran</p> <p style="text-align: center;">*Corresponding author: badraghehali@yahoo.com</p> <p><b>Abstract:</b> Distance education can be used for some aspects of most disciplines. For example, several institutions of higher education already have developed certificate programs, undergraduate programs, and graduate programs in health and physical education that are delivered using distance education methods. Eastern Oregon University, Emporia State University, Kutztown University, LaSalle University, the Medical College of Wisconsin, University of Wisconsin at Stevens Point, and Virginia Tech are among institutions integrating distance technology into their physical education programs. Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media.</p> <p>[Ali Badragheh. <b>Assessing Similarities and differences between Distance Education and e-learning.</b> Journal of American Science 2011;7(4):415-420]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Distance Education, E-learning</p>	<a href="#">Full Text</a>	63
64	<p style="text-align: center;"><b>Transmission Expansion Cost Allocation Based on Economic Benefit and Use of System</b></p> <p style="text-align: center;">Javad Nikoukar*, Mahmoud Reza Haghifam<sup>1</sup> and Abdorreza Panahi<sup>2</sup></p> <p>* Ph.D Student, Department of Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran.</p> <p><sup>1</sup> Department of Engineering, Tarbiat Modares University, Tehran, Iran.</p> <p><sup>2</sup> Department of Mathematics, Islamic Azad University, Saveh Branch, Saveh, Iran.</p> <p style="text-align: center;"><a href="mailto:j_nikoukar@yahoo.com">j_nikoukar@yahoo.com</a>, <a href="mailto:j_nikoukar@iau-saveh.ac.ir">j_nikoukar@iau-saveh.ac.ir</a></p> <p><b>Abstract:</b> In the deregulation power system, it is necessary to develop an appropriate pricing scheme that can</p>	<a href="#">Full Text</a>	64

	<p>provide the useful economic information to market participants, such as generators, transmission companies and customers. However, accurately assessment and allocating the transmission cost in the transmission pricing scheme is a challenge, although many methods have been proposed. The objective of this paper is to introduce a simple transmission expansion pricing scheme using proportional tree and economic benefit method, to allocate and price the transmission expansion among the participants. Numerical example using a test power system is presented to illustrate the effectiveness of the studied method.</p> <p>[Javad Nikoukar, Mahmoud Reza Haghifam, Abdorreza Panahi. Transmission Expansion Cost Allocation Based on Economic Benefit and Use of System. Journal of American Science 2011;7(4):421-426]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Transmission Expansion Cost Allocation, Economic Benefit, Use of System</p>		
65	<p style="text-align: center;"><b>Fuzzy Fractional Initial Value Problems</b></p> <p style="text-align: center;">Abdorreza Panahi <sup>1,*</sup> and Azam Noorafkan Zanjani <sup>1</sup></p> <p style="text-align: center;"><sup>1</sup>. Department of Mathematics, Islamic Azad University, Saveh Branch, Saveh, Iran. <a href="mailto:Panahi53@gmail.com">Panahi53@gmail.com</a>, <a href="mailto:Apanahi@iau-saveh.ac.ir">Apanahi@iau-saveh.ac.ir</a></p> <p><b>Abstract:</b> In this paper we define fuzzy fractional derivative in Caputo sense. Then using Adomian decomposition method we propose a method for computing approximations of solution of fuzzy fractional initial value problems. [Abdorreza Panahi, Azam Noorafkan Zanjani. Fuzzy Fractional Initial Value Problems. Journal of American Science 2011;7(4):427-431]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Fuzzy initial value problems, Caputo fractional derivative, Adomian decomposition method</p>	<a href="#">Full Text</a>	65
66	<p style="text-align: center;"><b>A model for health services priority setting for Iran</b></p> <p style="text-align: center;">Mohammadreza Amiresmailil <sup>1</sup>, Sogand Tourani <sup>2</sup> Atefeh esfandiari<sup>1</sup>, Vahid Yazdi Feyzabadi* <sup>3</sup>,</p> <p style="text-align: center;"><sup>1</sup>. Department of Health Administration, Kerman University of medical Sciences, Kerman, Iran <sup>2</sup>. Department of Health Administration, Tehran University of medical Sciences, Tehran, Iran <sup>3</sup>. Health deputy, Kerman University of medical Sciences, Kerman, Iran- corresponding author <a href="mailto:va.yazdi@gmail.com">va.yazdi@gmail.com</a></p> <p><b>Abstract:</b> Although priority setting has a long history, but until recent years even developed countries has mainly relied on implicit methods for priority setting,. But the evidence show that implicit priority setting is not acceptable since this method neither lead to benefit maximization, nor consider issues such as equity, equality and community participation. Hence it is necessary to design a model which is capable of overcoming these issues. Present qualitative research was carried out in six phases: 1.identifying models 2. Identifying attributes 3.ranking attributes 4. Evaluation of the models 5. Developing primary model 6. Validating primary model through Delphi technique. Content analysis and descriptive statistics were used for data analysis. Ten priority setting models identified. Evaluation of the models based on performance criteria demonstrated that HSW-DBM and ACE had the best performance against the criteria. On the other hand, historical allocation and decibels had the worst performance. suggested model better satisfies the performance criteria compared to existing models. The suggested model is enough flexible to be used at different levels and different settings of the health system. Applying this model can guide decision makers and policy makers toward optimum resource utilization and fair distribution. Journal of American Science 2011;7(4):432-439]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Economic approach, Priority setting model, Disease based model, Evidence based priority setting.</p>	<a href="#">Full Text</a>	66
67	<p style="text-align: center;"><b>Transmission Fixed Cost Allocation in Deregulated Environment based on Cooperative Game Theory</b></p> <p style="text-align: center;">Javad Nikoukar <sup>*1</sup>, Abdorreza Panahi<sup>2</sup></p> <p style="text-align: center;"><sup>1</sup>. Department of Engineering, Islamic Azad University, Saveh Branch, Saveh, Iran.</p>	<a href="#">Full Text</a>	67



	<p><sup>2</sup> Department of Mathematics, Islamic Azad University, Saveh Branch, Saveh, Iran.  <a href="mailto:j_nikoukar@yahoo.com">j_nikoukar@yahoo.com</a>, <a href="mailto:j_nikoukar@iau-saveh.ac.ir">j_nikoukar@iau-saveh.ac.ir</a></p> <p><b>Abstract:</b> The cooperative game theory is proposed to the transmission fixed cost allocation incurred to accommodate all the players. This method dominates the difficulties of conventionally used methods, such as postage stamp method and MW miles method, and encouraging the economically optimal usage of the transmission facilities. Under the deregulated environment, the cost needs to be allocated to the loads as well as generators fairly and unbiased so as to provide a locational signal to both types of players for optimal setting. This paper proposes game theoretic models based on the Shapley value approaches for transmission cost allocation problems under the deregulated environment. The obtained results are compared with the conventionally adopted methodologies to defend easy implementation and effectiveness of the proposed methodologies.  [Javad Nikoukar, Abdorreza Panahi. Transmission Fixed Cost Allocation in Deregulated Environment based on Cooperative Game Theory. Journal of American Science 2011;7(4):440-445]. (ISSN: 1545-1003 <a href="http://www.americanscience.org">http://www.americanscience.org</a>).</p> <p><b>Keywords:</b> Transmission Cost Allocation, Game Theory, Shapley Value, Coalition, Optimal Power Flow.</p>		
68	<p style="text-align: center;"><b>Fractional Differential Equations with Fuzzy Order</b></p> <p style="text-align: center;">Azam Noorafkan Zanjani<sup>*,1</sup>, Abdorreza Panahi<sup>1</sup></p> <p><sup>1</sup>. Department of Mathematics, Islamic Azad University, Saveh Branch, Saveh, Iran.  <a href="mailto:Azam57@gmail.com">Azam57@gmail.com</a></p> <p><b>Abstract:</b> In this paper we introduce fractional differential equations with fuzzy order. Then using Variational iteration method we propose a method for computing approximations of solution of fractional differential equations with fuzzy order.  [Azam Noorafkan Zanjani, Abdorreza Panahi. Differential Equations with Fuzzy order. Journal of American Science 2011;7(4):446-449]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Fuzzy number, Fractional derivative, Variational iteration method</p>	<a href="#">Full Text</a>	68
69	<p style="text-align: center;"><b>Production of Bio-active Bacteriocin from Some Bacterial Isolates and its Biological Use in controlling <i>Erwinia amylovora</i></b></p> <p style="text-align: center;"><sup>1</sup>Ghada. A. Youssef; <sup>2</sup>Sanaa S. Kabeil; <sup>2</sup>Elsayed E. Hafez and <sup>2</sup>William A. Botros</p> <p><sup>1</sup>Botany and microbiology Department, Faculty of Sciences, Alexandria University, P.O. Box 21511-Moharm Bey, Alexandria, Egypt. <sup>2</sup>Genetic Engineering and Biotechnology Research Institute, Mubarak City for Scientific Research and Technology Applications, New Borg El-Arab, Postal code 12934, Alexandria, Egypt.  <a href="mailto:amin_ghada@yahoo.com">amin_ghada@yahoo.com</a></p> <p><b>Abstract:</b> Some bacterial isolates were obtained from soil and plant samples contaminated with such a pathogen <i>Erwinia amylovora</i> is a Gram- negative enterobacterium, it is the causative agent of fire blight. The preliminary identification of the enzymes producing isolates indicated that only two of them were classified as members of <i>Bacilluseae</i>. These were the isolates <i>Bacillus mycoida</i> (B1), <i>Bacillus cereus</i> (B2). They were tested, and compared with the previously known isolate <i>Pontoae agglomerans</i> (WX112), as biocontrol agents. The three isolates <i>Bacillus mycoida</i> (B1), <i>Bacillus cereus</i> (B2) and <i>Pontoae agglomerans</i> (WX112) were resistible to heat, protease sensitive and producers of active proteins. The three isolates demonstrated superior activity against <i>E. amylovora</i> and could be bacteriocin producers. They showed high biocontrol activity. Moreover, the ability of the isolates to produce the extra-cellular inhibitory substances in a liquid culture was examined.  [Ghada. A. Youssef; Sanaa S. Kabeil; Elsayed E. Hafez and William A. Botros. <b>Production of Bio-active Bacteriocin from Some Bacterial Isolates and its Biological Use in controlling <i>Erwinia amylovora</i></b>. Journal of American Science 2011;7(4):450-459]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Antagonistic bacteria; Pear, biocontrol, <i>Erwinia amylovora</i>, Fire blight</p>	<a href="#">Full Text</a>	69

70	<p><b>Prediction of Traditional Climatic Changes Effect on Pomegranate Trees under Desert Conditions in El-maghara, Egypt</b></p> <p>Seidhom, S.H. and Abd-El-Rahman, G.</p> <p>Water Requirements and Meteorology Unite, Chemistry and Soil Physics Department, Desert Research Center, El-Matareya, Cairo, Egypt.</p> <p><b>Abstract:</b> The main aim of this study is to combat and forecasting climate changes, with some soil managements in El-Maghara Research Station at North Sinai, Egypt, on pomegranate trees. The applied treatments were irrigation intervals and soil mulching with drip irrigation in desert sandy soils and its impact on the water use efficiency and saving of irrigation water. A field experiment was carried out through split plot design during the three seasons 2008, 2009 and 2010 with pomegranate trees have 9 years age, planted at distances 3.6 X 3.6 meters (324 tree/fed). Experiments included 72 test unit consists of three irrigation intervals (2, 4 and 6 days) and three soil mulching practices under the trees (control without mulch, bitumen mulch and olive pomace mulch) and four replicates each have two trees, as the amount of irrigation water was calculated according to Penman - Monteith equation for data the last 10 years of the meteorological data of the region. The results were analyzed statistically which were as follow: (1) There is a detected local climatic change for the main meteorological data of the site compared either with 10 or 30 years recorded data. These changes are partially caused by the global climatic change in one hand and to the local Oasis effect in the site in the other hand. These changes play a positive role in enhancing the yield of pomegranate trees referring to the horticulture references. (2) A significant increase of the values of pomegranate fruit yield, crop water use efficiency, water economy, water saving, total revenue and total profit by increasing of air temperature and humidity of the atmosphere and increasing the irrigation period to 6 days. Olive pomace mulch under the trees, gave higher yield than bitumen mulch, and without mulch. (3) A significant decrease values of water consumptive use, crop coefficient of pomegranate, irrigation water use efficiency coefficient and environmental stress coefficient by increasing the irrigation period to be 6 days. Olive pomace mulching under the trees gave higher yield than bitumen mulch and then without mulch. (4) The highest for the application of economic olive pomace mulch under irrigation with a period of 6 days. In all cases, the applied treatments get higher investment ratios (IR) than the traditional one (2.25 LE/IL). The study recommends with using drip irrigation every 6 days by the amount of irrigation water calculated according to Penman-Monteith equation without addition leaching requirements, with plants residues mulch such as olive pomace under the trees, which gave the highest return of one pound investment with ~ 3.07 LE., taking into account the vulnerability of the study area to the phenomenon of the Continental and Oasis effect, under conditions similar to the study area. [Seidhom, S.H. and Abd-El-Rahman, G. <b>Prediction of Traditional Climatic Changes Effect on Pomegranate Trees under Desert Conditions in El-maghara, Egypt</b>. Journal of American Science 2011;7(4):460-473]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> climate change, irrigation intervals, mulching, pomegranate, water use efficiency, environmental stress coefficient.</p>	<p><a href="#">Full Text</a></p> <p>70</p>
71	<p><b>Effect of Instructional Guideline on Allergic Rhinitis Symptoms</b></p> <p>Hanan Shehata Mohamed*; Omaima Mohamed Esmat**; Mohamed Hassan Abd Allha*** and Hala Mahmoud Hafez****</p> <p>Medical Surgical Nursing<sup>*</sup>, Community Health Nursing<sup>**</sup>, Faculty of Nursing, Ain Shams University, E.N.T. Department<sup>***</sup> Clinical Pathology Department<sup>****</sup>, Faculty of Medicine, Ain Shams University</p> <p><b>Abstract:</b> Allergic rhinitis has been described as a disease that may appear quite bearable to the non sufferer. However, it is associated with impairments in how patients function physically, emotionally and socially. The aim of this study was to evaluate the effectiveness of instructional guideline on improving allergic rhinitis symptoms. Subjects and methods: A quasi experimental study design, using a purposeful sample of 60 adult patients suffering from allergic rhinitis with the following criteria: perennial rhinitis, their ages ranged between 18-55 years, non smokers and excluded, are the infected allergic rhinitis. Setting: The study was carried out at the (E.N.T.) clinic in El Demerdash Teaching Hospital, Ain Shams University. Tools: Three tools were used to collect data, 1) an</p>	<p><a href="#">Full Text</a></p> <p>71</p>

	<p>interviewing questionnaire, include socio-demographic characteristics of the study, assessment of patient's knowledge about the concept of allergic rhinitis and how to prevent it and questionnaire part to assess patients house hold hygiene practices and using of saline nasal lavage, 2) clinical assessment format including 2 parts a) clinical nose examination, b) Lab examination of nasal secretion for eosinophils, 3) instructional guideline leaflet for household hygiene practices and saline nasal lavage. Results of the study revealed positive effect for using topical saline lavage in addition to household hygiene practices in improving signs and symptoms of allergic rhinitis with more improvement with hypertonic saline in group (2). The study recommended the use of topical hypertonic nasal saline lavage in improving of allergic rhinitis symptoms and increase health awareness about the importance of nose hygiene and household hygiene practices.</p> <p>[Hanan Shehata Mohamed; Omaina Mohamed Esmat; Mohamed Hassan Abd Allhaand Hala Mahmoud Hafez. <b>Effect of Instructional Guideline on Allergic Rhinitis Symptoms.</b> Journal of American Science 2011;7(4):474-482]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Instructional guideline, allergic rhinitis symptoms, saline solution, hygienic practices, smell sense.</p>		
72	<p style="text-align: center;"><b>Nuclear Research Reactors Accidents Pattern Recognition Using Artificial Neural Networks</b></p> <p style="text-align: center;">** Abdelfattah A. Ahmed; *Nwal Ahmed Alfishawy; * Mohamed A. Albrdini, and **Imbaby I. Mahmoud</p> <p style="text-align: center;">* Minufiya university, Faculty of Comp. &amp; Inf., Minuf, Egypt. ** Atomic Energy Authority, Atomic Energy Research Center, Inshas, Egypt.</p> <p><b>Abstract:</b> The patterns recognition of measured quantities for the diagnostic purposes in the field of nuclear research reactors is very important. It represents one of the fundamental tasks for the operation and accidents management. In this paper, the Nuclear Research Reactors accident's pattern recognition is tackled within neural network approach. Such patterns are introduced initially without noise. The simulated output values of the matrix's diagonal are larger than 0.9, (approximately equal 1), this means the outputs is approximately equal the targets and the network is well trained. To increase the reliability of such neural network, the noise ratio up to 50% was added for training in order to ensure the recognition of these patterns if it introduced with noise. Also, because of the limited amount of data (patterns), this work has taken care to increase the size of these data (patterns) when it introduced as training packages, by adding different random noise ratios as different sets at different times to ensure proper training of the neural network components. The neural network has been tested after training, and also finally tested by providing separate data patterns to ensure the ability of the constructed network to recognize these patterns. Experiments have shown excellent results; where the network did not make any errors for input vectors (patterns) with the noise level from 0.00 up to 0.14. When the noise level is larger than 0.15 was added to the input vectors (patterns) both networks began making errors.</p> <p>[Abdelfattah A. Ahmed; Nwal Ahmed Alfishawy; Mohamed A. Albrdini, and Imbaby I. Mahmoud. Nuclear Research Reactors Accidents Pattern Recognition Using Artificial Neural Networks. Journal of American Science 2011;7(4):483-492]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Artificial neural networks (ANN), Nuclear Research Reactors, and MATLAB.</p>	<a href="#">Full Text</a>	72
73	<p style="text-align: center;"><b>The Role of rural women empowerment in accelerating rural development</b></p> <p style="text-align: center;"><sup>1</sup> Azita Zamani, <sup>2</sup> Nahideh Erfanirad <sup>1, 2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran *Corresponding author: mehran11070@yahoo.com</p> <p><b>Abstract:</b> rural women take different responsibility and roles such as producers of crops , ranching and keeping poultry , children education , housekeeping , supervising family economy and managing it , collecting firewood , weaving carpet , so illiterate women who haven't possibility to utilize mass media properly too , wouldn't able to do their duties and roles and also wouldn't be affective to develop rural societies . So importance of education is very critical for rural women especially extensional educations. Approximately in most UN reports, women has been considered as greatest deprived group at human societies, while at global level, about two third of all affairs is done by women. But only one third of all recorded affairs relates to women. And also just 1% of proceeds of estates and assets of world belong to women and two third of illiterates of world are women, however they form 50% of workforce at agriculture part and they produce half of foods at all over the world.</p>	<a href="#">Full Text</a>	73

	<p>[Azita Zamani and Nahideh Erfanirad. <b>The Role of rural women empowerment in accelerating rural development.</b> Journal of American Science 2011;7(4): 493-498]. (ISSN: 1545-1003).<a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> empowerment, rural women, rural development</p>		
74	<p><b>Comparison between Hypertonic Saline and Isotonic Saline in Resuscitating Hypotensive Patients with Severe Traumatic Brain Injury; a Prospective Randomized Study</b></p> <p>Habashi Abd El Basset El Hamady<sup>1</sup>, Hesham Adel Abulenein<sup>2</sup>, Akram Muhammad Fayed<sup>*3</sup>, Magdy Akel Sorour<sup>1</sup>, Hossam El-Din Moustafa Fayed<sup>4</sup></p> <p><sup>1</sup>Department of General Surgery, <sup>2</sup>Department of Neurosurgery, <sup>3</sup>Department of Critical Care Medicine, <sup>4</sup>Emergency Department, Faculty of Medicine, University of Alexandria, Egypt. *<a href="mailto:amfayed@gmail.com">amfayed@gmail.com</a></p> <p><b>Abstract:</b> Introduction: The use of hypertonic saline in resuscitation of patients with traumatic brain injury (TBI) has been studied several times in the literatures. According to the knowledge of the authors, it was not compared to normal saline in resuscitation of such patient group in a head to head study. Hypothesis: To evaluate the efficacy of the use of a bolus 3% HTS against isotonic crystalloids in the resuscitation of hypotension associated with severe TBI. As regards early hemodynamic parameters, survival and neurological =outcome after 3 months. Methods: 40 patients presented with hypotension (systolic blood pressure &lt;100 mmHg) and severe TBI (GCS &lt;9) were randomly classified into; GroupI: received 250 mL of 3% HTS as the primary resuscitation solution, GroupII (Control group): received 250 mL of normal saline, Then fluid resuscitation was continued as the condition of each patient dictates. Results: HTS group had statistically significant higher blood pressure (after one hour of resuscitation; p value = 0.003) than the control group though they received less amount of fluids (p value=0.0001). Regarding Glasgow outcome scale (GOS) at 3 months, there was a trend towards better outcome in the HTS group but that was not statistically significant. In the HTS group, the patients who survived were more, less patients with persistent vegetative state and more patients with good recovery or moderate disability than the control group. The mean of the GOS was higher in the HTS group but again with no statistically significant difference. In a subgroup analysis, HTS did not have any statistically significant difference on survival between the groups regarding the time interval between trauma and admission. Moreover, the use of HTS did not show statistically significant difference in the survival of patients having isolated head injury than those with associated injuries. Most importantly, there was no added beneficial effect on different degrees of severity of head trauma classified according to either GCS at admission or Marshall's classification of CT brain findings. Conclusions: HTS is effective in elevation of blood pressure in severe TBI patients while less fluid is required. Although not statistically significant, there was a trend towards improved outcome in severe TBI patients who received HTS. [Habashi Abd El Basset El Hamady, Hesham Adel Abulenein, Akram Muhammad Fayed Magdy Akel Sorour , Hossam El-Din Moustafa Fayed. <b>Comparison between Hypertonic Saline and Isotonic Saline in Resuscitating Hypotensive Patients with Severe Traumatic Brain Injury; a Prospective Randomized Study.</b> Journal of American Science 2011;7(4):499-508]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Hypertonic Saline; Isotonic Saline; Resuscitating Hypotensive Patient; Traumatic Brain</p>	<a href="#">Full Text</a>	74
75	<p><b>Prediction of the Outcome of Patients with Acute Hydrocarbons Poisoning using Poison Severity Scoring System; A Prospective Study</b></p> <p>Hoda Fouad Abd El Salam<sup>1</sup>, Akram Muhammad Fayed<sup>*2</sup> and Marwa Mohamed Abdel Muneum<sup>2</sup></p> <p><sup>1</sup>Department of Forensic Medicine and Clinical Toxicology  <sup>2</sup>Department of Critical Care Medicine, Faculty of Medicine, University of Alexandria, Egypt  *<a href="mailto:amfayed@gmail.com">amfayed@gmail.com</a></p> <p><b>Abstract:</b> PURPOSE: Accidental hydrocarbons ingestion remains a serious contributor to childhood poisoning in low socioeconomic groups, with a high incidence of morbidity and occasional mortality. Hydrocarbon toxicities affect mainly the respiratory system and pulmonary pathology is the most serious complication. Although most children survive without complications or sequelae, some progress rapidly to respiratory failure and death. In this</p>	<a href="#">Full Text</a>	75

	<p>study, we aimed to investigate whether it was possible to predict outcome in hydrocarbons poisoning using a scoring system based on simple clinical parameters recorded solely on admission. <b>METHODS:</b> 100 patients with acute hydrocarbon toxicity consequently admitted to the Poisoning center will be subjected to full history taking, complete physical examination. Plain chest x-ray, ECG, ABG and routine blood investigations (CBC, Na, K, serum and Creatinine, AST and ALT) were done on admission. All patients were graded according to the Poison Severity Score (PSS) to either: None (0), Minor (1), Moderate (2), Severe (3) or Fatal (4). Their initial grading was correlated with their outcomes: Need for Intensive Care Unit admission, mechanical ventilation (MV) and the length of ICU and hospital stay as well as hospital mortality. <b>RESULTS:</b> 100% of the patients with grade (None=0) recovered completely and none was admitted to the ICU with a mean hospital stay of <math>1\pm0.0</math> day. 100% of the patients with grade (Minor=1) recovered completely and none was admitted to the ICU with a mean hospital stay of <math>1.26\pm0.44</math> days. 100% of the patients with grade 2 (Moderate) recovered completely. All of them were admitted to the ICU, 64.3% of them needed invasive mechanical ventilation and 35.7% did not. The mean hospital stay was <math>3.50\pm0.65</math> days and the mean ICU stay was <math>2.50\pm0.65</math> days. 25% of the patients with grade 3 (Severe) recovered completely and 75% died (hospital mortality). All of them were admitted to the ICU and needed invasive mechanical ventilation. Their mean hospital stay was <math>5.25\pm2.99</math> days and the mean ICU stay was <math>5\pm2.58</math> days. <b>CONCLUSIONS:</b> According to this study, the PSS could be a useful tool to predict outcome in patients admitted with hydrocarbon toxicity as the different grades of the PSS system had significant correlation with patients' outcome. Patients presenting with hydrocarbons with a PSS of 2 could be directly admitted to the ICU for possible need of MV because of associated unfavorable outcome.</p> <p>[Hoda Fouad Abd El Salam , Akram Muhammad Fayed and Marwa Mohamed Abdel Muneem. <b>Prediction of the Outcome of Patients with Acute Hydrocarbons Poisoning using Poison Severity Scoring System; A Prospective Study.</b> Journal of American Science 2011;7(4):509-518]. (ISSN: 1545-1003).  <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Patients; Acute Hydrocarbons; Poison; Scoring System;Prospective Study</p>		
76	<p style="text-align: center;"><b>Assessing Advantages and Disadvantages of E-learning</b></p> <p style="text-align: center;"><sup>1</sup> Molouk Gharibpanah, <sup>2</sup> Azita Zamani  <sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran  *Corresponding author: mehran11070@yahoo.com</p> <p><b>Abstract:</b> Distance education is a method of education in which the learner is physically separated from the teacher and the institution sponsoring the instruction. It may be used on its own, or in conjunction with other forms of education, including face-to-face instruction. In any distance education process there must be a teacher, one or more students, and a course or curriculum that the teacher is capable of teaching and the student is trying to learn. The contract between teacher and learner, whether in a traditional classroom or distance education, requires that the student be taught, assessed, given guidance and, where appropriate, prepared for examinations that may or may not be conducted by the institution. This must be accomplished by two-way communication. Learning may be undertaken either individually or in groups; in either case, it is accomplished in the physical absence of the teacher in distance education. Where distance teaching materials are provided to learners, they are structured in ways that facilitate learning at a distance.</p> <p>[Molouk Gharibpanah and Azita Zamani. <b>Assessing Advantages and Disadvantages of E-learning.</b> Journal of American Science 2011;7(4): 519-524]. (ISSN: 1545-1003).<a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> E-learning, distance education</p>	<a href="#">Full Text</a>	76
77	<p style="text-align: center;"><b>Effect of closed versus open Suction System on Cardiopulmonary Parameters of Ventilated Neonates</b></p> <p style="text-align: center;">Gehan M. Khamis<sup>1</sup>, Omnia G.Waziry<sup>1</sup>, Abdel-Halim A. Badr-El-Din<sup>2</sup>, Magda M. El- Sayed <sup>1</sup></p> <p style="text-align: center;"><sup>1</sup> Department of Pediatric Nursing, Faculty of Nursing, University of Alexandria, Egypt  <sup>2</sup>Department of Pediatrics, Faculty of Medicine, University of Alexandria, Egypt</p> <p><b>Abstract:</b> Removal of airway secretion is required in many neonates in the intensive care setting, and the process is most critical with respiratory problems. Clearance of secretions is essential in the mechanically ventilated neonates, because these neonates breathe slowly through an artificial airway. So, accumulation of secretions can</p>	<a href="#">Full Text</a>	77



	<p>lead to airway occlusion, serious physiological abnormalities and even death. Therefore, suctioning is essential for removing secretions and maintaining airway patency. This study aimed to determine the effect of closed versus open suction system on the cardiopulmonary parameters of ventilated neonates. The study was conducted at the Neonatal Intensive Care Unit at El-Shatby Maternity University Hospital in Alexandria. A Convenient sample of 60 neonates was randomly assigned into two groups. Thirty neonates (group A) were suctioned by closed suction system, and the other 30 neonates (group B) were suctioned by open suction system. The results revealed that that the closed suction system was more effective in maintaining the oxygen saturation, capillary refill and has less negative impact on the occurrence of cardiac arrhythmia as cardiopulmonary parameters. Other physiological parameters were also better maintained with closed than with opened suction system.</p> <p>[Gehan M. Khamis, Omnia G.Waziry, Abdel-Halim A. Badr-El-Din, Magda M. El- Sayed. <b>Effect of closed versus open Suction System on Cardiopulmonary Parameters of Ventilated Neonates.</b> Journal of American Science 2011;7(4):525-534]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> suction system, cardiopulmonary, neonates, airway patency</p>		
78	<p><b>Awareness of Sodium Lauryl Sulfate &amp; Sodium Laureth Sulfate Health Hazards among Users</b></p> <p>Ghada F. El-Sharkawy</p> <p>Public Health &amp; Community Medicine Department, Faculty of Medicine, Zagazig University, Egypt  <a href="mailto:ghada_el_sharkawy@hotmail.com">ghada_el_sharkawy@hotmail.com</a></p> <p><b>Abstract:</b> Some ingredients of personal care products have health hazards and population awareness of these health hazards helps to reduce their occurrence, late reporting &amp; misdiagnosis. So, this study was done to assess the awareness of a sample of Egyptian users with health hazards of foam producing agents; Sodium Lauryl Sulfate and Sodium Laureth Sulfate and to test the influence of socio-demographic characters on awareness. A self-administered questionnaire was used for participants to collect data of some socio-demographic characteristics, knowledge about these substances, reading ingredients practice and attitude towards change. The results showed that the awareness of Sodium Lauryl Sulfate and Sodium Laureth Sulfate health hazards was minimal. More than 81% of the interviewed persons never heard about them or know that a harmful ingredient may be present in personal care products. The significant factors associated with hearing about this were female gender, practice reading compositions, living in a villa and having a car. The basic practice of reading the composition of what one use was deficient among 38% of participants but the attitude towards stop or change harmful products was present among the majority (94%). In conclusion, the level of awareness of Sodium Lauryl Sulfate and Sodium Laureth Sulfate health hazards was low among Egyptian users as many difficulties face the practice of reading products' ingredients but the attitude towards change is very much encouraging. Therefore, agreeing on an international code for labeling of publicly used products, increasing the public's awareness and further researches are very much needed.</p> <p>[Ghada F. El-Sharkawy. <b>Awareness of Sodium Lauryl Sulfate &amp; Sodium Laureth Sulfate Health Hazards among Users.</b> Journal of American Science 2011;7(4):535-541]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Sodium Lauryl Sulfate; Sodium Laureth Sulfate Health Hazards; User</p>	<a href="#">Full Text</a>	78
79	<p><b>Ratio of Middle Cerebral Artery / Umbilical Artery Doppler Velocimetry and Status of Newborn in Postterm Pregnancy</b></p> <p><b>El-Sokkary M.* , Omran M., and Ahmed H.</b></p> <p>Department of Obstetrics and Gynecology – Ain Shams University, Abbasyia – Cairo, Egypt  <a href="mailto:dr.m.elsokkary@live.com">dr.m.elsokkary@live.com</a></p> <p><b>Abstract:</b> Objective: Doppler velocimetry studies of placental and fetal circulation can provide important information regarding fetal well-being providing an opportunity to improve fetal outcome. The present study was undertaken to evaluate the role of middle cerebral to umbilical artery blood velocity waveform's systolic/diastolic ratio (MCA/UA) as a predictor of perinatal outcome in posttrem pregnant women. Patients and Methods: This</p>	<a href="#">Full Text</a>	79

	<p>prospective case control study included one hundred pregnant women who were stratified into two groups. Fifty pregnant women during the third trimester (control group = group A) and fifty pregnant women with gestational age &gt; 41 weeks (case group = group B). The results of the MCA/UA ratio were evaluated with respect to the outcome of the infants and adverse perinatal outcome, defined as perinatal death, cesarean delivery for fetal distress, admission to the neonatal intensive care unit, days in the neonatal intensive care unit (NICU) or low Apgar score. Results: The MCA RI/UA RI ratio with cutoff value = 0.85 was found to be the most sensitive parameter in the prediction of adverse prenatal outcome. Among 22 cases admitted in NICU, 15 of them had a ratio below 0.85 (73.7%) and only 7 cases above 0.85 (26.3%). The Cereboplacental ratio screening efficiency for prediction of prenatal outcome (Birth weight &lt;10th percentile) was 47% Sensitivity, 90% Specificity, 95% positive predictive value, 43% Negative predictive value, and for prediction of admission to NICU was 43.5% Sensitivity, 90% Specificity, 91% Positive predictive value, 45% Negative predictive value compared with the results of the present study (MCA/UA) PI ratio showed a 73.7% sensitivity and 68.3% specificity and a 52% PPV and 85% NPV in prediction of prenatal outcome (Birth weight &lt;10th percentile) and 71% sensitivity and 72% specificity and a 79% PPV and 63% NPV in prediction of admission to NICU. Conclusion: Doppler velocimetry studies of placental and fetal circulation can provide important information regarding fetal well-being, yielding an opportunity to improve fetal outcome. Although the sample size of our study was small, our results suggested that the MCA/UA Doppler ratio of less than 1 was a good predictive tool for neonatal outcome in postterm pregnant women and could be used to identify fetuses at risk of morbidity.</p> <p>[El-Sokkary M., Omran M., and Ahmed H. <b>Ratio of Middle Cerebral Artery / Umbilical Artery Doppler Velocimetry and Status of Newborn in Postterm Pregnancy.</b> Journal of American Science 2011;7(4):542-549]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key Words:</b> Doppler – middle cerebral artery to umbilical artery ratio - postterm pregnancy</p>		
80	<p><b>Decentralization of agricultural extension: New way to improve rural development in Third World</b></p> <p>Sharareh Khodamoradi<sup>1</sup> and Mohammad Abedi<sup>2</sup></p> <p><sup>1, 2</sup> Department of Agricultural Extension Education, Science and Research Branch, Islamic Azad University, Tehran, Iran. *Corresponding author: abedi114@yahoo.com</p> <p><b>Abstract:</b> The evolution of public agricultural extension arrived at a worldwide turning point in the 1980s, one that represented the end of a major phase in the growth of publicly funded extension in both the developed and developing world. Agricultural extension increasingly has become defined as one or other of (apparently) differentiated activities of technology transfer or rural development. Agricultural extension is a non-formal type of education that provides advisory services by the use of educational approach in acquiring knowledge and skills to deal with the growing needs of global world. Diverse agricultural extension funding and delivery arrangements have been undertaken since the mid-1980s by governments worldwide in the name of "privatization." When agricultural extension is discussed, privatization is used in the broadest sense – of introducing or increasing private sector participation, which does not necessarily imply a transfer of designated state-owned assets to the private sector. In fact, various cost-recovery, commercialization, and other so-called privatization alternatives have been adopted to improve agricultural extension.</p> <p>[Sharareh Khodamoradi and Mohammad Abedi. <b>Decentralization of agricultural extension: New way to improve rural development in Third World.</b> Journal of American Science 2011;7(4):550-555]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Decentralization, Agricultural extension</p>	<a href="#">Full Text</a>	80
81	<p><b>Comparative Studies on the Renal Structural Aspects of the Mammalian Species Inhabiting Different Habitats</b></p> <p><b>Zeinab M. A. El-Gohary<sup>1</sup>; Souad, A. Khalifa<sup>1</sup>; Afaf M. El-Said Fahmy<sup>2</sup> and Yasmin, M.Tag<sup>*1</sup></b></p> <p><sup>1</sup>Zoology Dept., Faculty of Science, Mansoura University, Egypt  <sup>2</sup>Biochemistry Dept., Faculty of Medicine, Mansoura University, Egypt  <a href="mailto:*yasmintag85@yahoo.com">*yasmintag85@yahoo.com</a></p>	<a href="#">Full Text</a>	81

	<p><b>Abstract:</b> The current investigation was carried out to reveal the structural aspects of the kidney of the herbivorous guinea pigs, <i>Cavia porcellus</i>, inhabiting mesic environment, the insectivorous hedgehogs, <i>Paraechinus aethiopicus</i>, inhabiting arid environment and the omnivorous spiny mice, <i>Acomys russatus</i>, inhabiting arid environment in an attempt to elucidate whether variations in the nature of habitat and /or diet may associated with special structural renal adaptations. The kidneys of the selected species were studied morphologically, histologically and ultrastructurally. The results were markedly varied, with the spiny mice having the lightest body weight, the heaviest relative kidney weight, the well-developed complex renal pelvis, the fewest nephron numbers, the least total glomerular volume (TGV), numerous giant vascular bundles, the fewest and the narrowest filtration slits, the thickest basal lamina of both glomerular capillaries and epithelial lining of proximal and distal tubules, well developed elaborated basal infoldings and the greatest number of elongated mitochondria compared to those of the guinea pigs and the hedgehogs respectively. In contrast, the hedgehogs showed some peculiar structural features, including the huge nephron number and the greatest total glomerular volume.</p> <p>[Zeinab M. A. El-Gohary; Souad, A. Khalifa; Afaf M. El-Said Fahmy and Yasmin, M.Tag. <b>Comparative Studies on the Renal Structural Aspects of the Mammalian Species Inhabiting Different Habitats</b>. Journal of American Science 2011;7(4):556-565]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Rodents, Insectivorous, Kidney, Habitat, Histology</p>		
82	<p style="text-align: center;"><b>Efficacy of Neural Mobilization in Treatment of Low Back Dysfunctions</b></p> <p style="text-align: center;">Sahar M. Adel</p> <p style="text-align: center;">Department of Basic Science, Faculty of Physical Therapy, Cairo University, Cairo, Egypt. <a href="mailto:dr_sahar_adel@hotmail.com">dr_sahar_adel@hotmail.com</a></p> <p><b>Abstract:</b> The study was conducted to investigate the effect of lumbar mobilization techniques and neural mobilization technique on sciatic pain, functional disabilities, centralization of symptoms in patients, latency of Hoffmann reflex, and of degree of nerve root compromise in chronic low back dysfunction (LBD). Pre-test post-test group design has been used. Sixty patients with chronic (LBD) from both sexes were involved, aged between 30 – 60 years. They were divided into two equal groups, Group (A) received lumbar spine mobilization and exercise intervention and Group (B) received Straight leg raising stretching (SLR) in addition to lumbar mobilization and exercise. Self-report measures included a body diagram to assess the distribution of symptoms, numeric pain rating scale (NPRS), modified Oswestry Disability Index (ODI), Patients recorded the location of their symptoms on the body diagram to determine the extent to which centralization occurred after treatment, The results of study revealed that: there was a significant difference between both groups on pain (<math>p = 0.006</math>), functional disabilities improvement (<math>0.001</math>), location of symptoms (<math>p = 0.083</math>) and sciatic nerve root compression (<math>p = 0.035</math>). However there is no significant Differences in H-reflex latency (<math>p = 0.873</math>) between group A and group B (post test). It is concluded that straight leg raising (SLR) stretching may be beneficial in the management of patients with LBD. SLR stretching in addition to lumbar spine mobilization and exercise was beneficial in improving pain, reducing short-term disability and promoting centralization of symptoms in this group of patients.</p> <p>[Sahar M. Ade <b>Efficacy of Neural Mobilization in Treatment of Low Back Dysfunctions</b>. Journal of American <a href="http://www.americanscience.org">http://www.americanscience.org</a> Science 2011;7(4):566-573]. (ISSN: 1545-1003).</p> <p><b>Key words:</b> Chronic low back dysfunction, Straight leg raising (SLR) stretching, lumbar mobilization, H-reflex latency</p>	<a href="#">Full Text</a>	82
83	<p style="text-align: center;"><b>Preparation of Ordered Nano-Titania Arrays and Electrodeposition of Nano- Hydroxyapatite Crystals on Ti-6Al%-4%V Dental Implant Surfaces</b></p> <p style="text-align: center;"><b>Heba A. Shalaby<sup>*1</sup>, Azza M. Hashem<sup>2</sup>, Nadia A. Badr<sup>2</sup>, Madiha M. Shoeib<sup>3</sup> and Monazzah G. Khafagy<sup>4</sup></b></p> <p style="text-align: center;"><sup>1</sup>Faculty of Oral and Dental Medicine, Nahda University, Bani Swif, Egupt <sup>2</sup>Department of dental biomaterial, Faculty of Oral and Dental Medicine, Cairo University, Cairo, Egypt <sup>3</sup>Department of Chemistry and Technology of Ceramic Materials, Head of Surface Treatment and Corrosion Control Department at Central Metallurgical Research and Development Institute, Egypt <sup>4</sup>Departments of Spectroscopy, Physics Division, National Research Center, Cairo, Egypt</p>	<a href="#">Full Text</a>	83

	<p style="text-align: center;"><a href="mailto:hebashalaby_dental@yahoo.com">*hebashalaby_dental@yahoo.com</a></p> <p><b>Abstract:</b> Nano-titania surfaces enhance rapid biointegration at bone/ implant interfaces. In this study, nanotechnology was employed to prepare Ti-6Al-4V dental implant surface. Titanium alloy discs were anodized at room temperature and heat treated (Group1). Then, electrodeposition technique was used to coat the anodized surfaces with hydroxy-apatite (Group2) followed by alkaline hydrothermal treatment (Group3). The different surfaces were characterized by XRD, IFM, SEM and FTIR. The results showed that anodization of Ti-alloy disks led to the formation of ordered nano-tubes arrays made of titanium oxide Anatase phase which acted as a template for the precipitation of nano-hydroxy-apatite crystals. Conclusion: anodization is a simple method to prepare ordered nano-titania that promoted the electrodeposition of highly nano- crystalline bioactive HA coating. [Heba A. Shalaby, Azza M. Hashem, Nadia A. Badr, Madiha M. Shoeib and Monazzah G. Khafagy. <b>Preparation of Ordered Nano-Titania Arrays and Electrodeposition of Nano- Hydroxyapatite Crystals on Ti-6Al%-4%V Dental Implant Surfaces.</b> Journal of American Science 2011;7(4):574-584]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> anodization, nanotitania, anatase, electrodeposition, nanohydroxyapatite</p>		
84	<p style="text-align: center;"><b>Kinetics of Dissolution of COM Crystals in the Presence of some Organic Solvents</b></p> <p style="text-align: center;"><b>N.S. yehia*, F.A. Essa and M.G. Abbas</b></p> <p style="text-align: center;">Deportment of chemistry, Menoufia University, Egypt dr_naema salem @yahoo.com m_chemistry84@yahoo.com</p> <p><b>Abstract:</b> Dissolution rates of calcium oxalate monohydrate crystals were studied in absence and presence of propionic acid (PA), acetone, dimethyl-sulfoxide (DMSO), iso propanol (IPA) and dimethyl-formamide (DMF). It was found at the experimental conditions of PH : 6.5, t = 37<sup>0</sup>C, I= 0.15 mol dm<sup>-3</sup> and σ = 0.09, the dissolution followed surface controlled mechanism. The order of inhibition of additives on the rates of dissolution of COM crystals at experimental conditions was: PA &gt; acetone &gt; DMSO &gt; IPA &gt; DMF. The effects of change of I, pH, σ and Temperature on the rates of dissolution of COM crystals in the presence of, 10<sup>-7</sup> mol dm<sup>-3</sup> were studied. [N.S. yehia, F.A. Essa and M.G. Abbas. <b>Kinetics of Dissolution of COM Crystals in the Presence of some Organic Solvents.</b> Journal of American Science 2011;7(4):585-591]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Kinetics of Dissolution; Crystal; Organic Solvent</p>	<a href="#">Full Text</a>	84
85	<p style="text-align: center;"><b>Risk Factors of Protein Energy Malnutrition "Kwashiorkor and Marasmus" among Children Under Five Years of Age in Assiut University Children Hospital</b></p> <p style="text-align: center;"><b>Awatef E. Ahmed, Zienab M. Elkady, Asmaa A. Hussein, and Amal A. Abdrbou</b></p> <p style="text-align: center;">Departments of Pediatric Nursing, Faculty of Nursing and Pediatrics, Faculty of Medicine Assiut University Hospital, Assiut University, Egypt</p> <p><b>Abstract:</b> The aim of the study is to identify the risk factors of protein energy malnutrition among children under five years of age in Assiut university children hospital. A correlation descriptive research design was chosen for this study. A convenient sampling design was followed to include children suffering from protein energy malnutrition aged below 5 years. Control group was purposively selected to be nearly age and sex matched. A total of 150 study and 150 control were included. The results revealed that PEM was more found in children in families of middle and low socioeconomic status with statistically significant differences, history of malnutrition in other sibling and younger age than others, statistically significant differences between practices of mothers in the cases than the control groups were found regarding breast feeding, artificial feeding and additional and adult food with low level of satisfactory practices observed among mothers in the cases than those in the control groups. From this study it can be concluded that several risk factors were found to be associated with PEM including, lower education level of the mother, number of children in the family as the number of children in the family decreased , the prevalence of PEM increased, low and middle family socioeconomic status, age of the child, children with the</p>	<a href="#">Full Text</a>	85

	<p>younger age are more vulnerable to have PEM than those of older age and mothers' practices regarding feeding of their children (breast feeding, artificial feeding as well as additional and adult food) unsatisfactory practices of mothers regarding feeding of their children increase the prevalence of PEM among their children. This study recommended that Supporting and promotion of breast feeding, avoid using of artificial feeding and bottles, health education to the mothers about proper feeding practices, breast feeding, artificial feeding and additional and adult food to prevent PEM, increasing mother's awareness related to risk factors of PEM and how to manage the different infections among their children and encourage vaccination at the appropriate time.</p> <p>[Awatef E. Ahmed, Zienab M. Elkady, Asmaa A. Hussein, and Amal A. Abdrbou. <b>Risk Factors of Protein Energy Malnutrition "Kwashiorkor and Marasmus" among Children Under Five Years of Age in Assiut University Children Hospital.</b> Journal of American Science 2011;7(4):592-604]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Risk Factor; Protein Energy Malnutrition; Kwashiorkor and Marasmus; Children; Assiut University Children Hospital</p>		
86	<p><b>Prevalence of Asymptomatic Bacteriuria in Antenatal Women with Preterm Labor at an Egyptian Tertiary Center</b></p> <p>El-Sokkary M.</p> <p>Department of Obstetrics and Gynecology – Ain Shams University Abbasyia, Cairo, Egypt <a href="mailto:dr.m.elsokkary@live.com">dr.m.elsokkary@live.com</a></p> <p><b>Abstract:</b> Background and objective: Urinary tract is second only to the respiratory tract in acquiring microbial infection, especially in females. It is more common in pregnant than in non-pregnant women<sup>1,2</sup>. Studies from different parts of the world have showed that urinary tract infection (UTI) during pregnancy leads to low birth weight babies, increased perinatal mortality and premature births along with acute and chronic sequelae in mothers<sup>3</sup>. This study was conducted to explore the relation of asymptomatic bacteriuria in Egyptian females to preterm labor and different aspects of UTI during pregnancy. Patients and Methods: This was a cross sectional study that was done at Ain Shams University Maternity Hospital. The study included 1830 antenatal women, over a 3-year period, between January 2007 and December 2009. Out of these patients; 780 patients had premature uterine contractions while 1050 antenatal women with no history of premature uterine contractions. Results: Prevalence of asymptomatic bacteriuria (ASB) in those with premature uterine contractions and others with no history of uterine contractions were 23.5% and 16.9% respectively. A highly significant association between ASB of the mothers and preterm labor was noted. Conclusion &amp; recommendations: The results of this study suggest that asymptomatic bacteriuria were more prone to develop preterm delivery than that of the healthy mothers (without bacteriuria). The unwanted sufferings of the pregnant mothers and their offspring could easily be prevented by early screening and treatment of asymptomatic bacteriuria in pregnancy which must be considered as an essential part of antenatal care in order to reduce the morbidities associated with preterm labor.</p> <p>[El-Sokkary M. <b>Prevalence of Asymptomatic Bacteriuria in Antenatal Women with Preterm Labor at an Egyptian Tertiary Center.</b> Journal of American Science 2011;7(4):605-610]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key Words:</b> asymptomatic bacteriuria – preterm labor</p>	<a href="#">Full Text</a>	86
87	<p><b>Cultural Awareness about Female Genital Mutilation among Female Employees of Minia University</b></p> <p>Ekbal A. Emam<sup>1*</sup>, Abeer M. EL-Maghawri<sup>2</sup>, and Shokria A. Labeeb<sup>3</sup></p> <p>1. Department of Woman Health and Gynecology Nursing, Faculty of Nursing, Minia University, Egypt 2. Department of Community Health, Faculty of Nursing, Bani-Swaif University, Egypt 3. Department of Community Health, Faculty of Nursing, Assiut University, Egypt <a href="mailto:dr_ekbal_2010@yahoo.com">* dr_ekbal_2010@yahoo.com</a></p> <p><b>Abstract :</b> Female genital mutilation (FGM) is a reflection of the violation of women's basic human rights. The new prohibiting laws In Egypt seem to have no significant effect on its prevalence. The aim of this study was to</p>	<a href="#">Full Text</a>	87



	<p>assess the awareness and attitudes of women in Upper Egypt regarding FGM, and to identify the underlying motives that may help in change. This cross-sectional study was conducted on convenience sample of 300 women working in Minia University, Upper Egypt. Data were collected using an interview questionnaire including an attitude scale. Data collection lasted from 19/11/2009 to 17/5/2010. Women's age ranged between 18 and 60 years, and 30.7% were illiterate; 95.7% of women and 77.3% of their daughters were circumcised. The attitude towards FGM was generally encouraging it. Multivariate analysis showed that lower education and having been circumcised were the statistically significant independent predictors of the attitude score. Meanwhile, the determinants of getting daughter circumcised were woman's older age, religious belief, lower education, and more encouraging attitude score.</p> <p>It is concluded that FGM is still an important and culturally sensitive issue in Upper Egypt, and most women, especially with low education, encourage it mainly on religious grounds. Health education efforts should be more focused on illiterate women, and must be supported by religious scholars.</p> <p>[Ekbal A. Emam, Abeer M. EL-Maghawri, and Shokria A. Labeed. <b>Cultural Awareness about Female Genital Mutilation among Female Employees of Minia University</b>. Journal of American Science 2011;7(4):611-617]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> complication, cultural background, female circumcision, genital mutilation</p>		
88	<p><b>Effect of Acidifiers on Gastrointestinal Tract Integrity, Zootechnical Performance and Colonization of <i>Clostridium Perfringens</i> and Aerobic Bacteria in Broiler Chickens</b></p> <p><b>M.H.H. Awaad<sup>1*</sup>, A.M. Atta<sup>2</sup>, M. Elmenawey<sup>2</sup>, B. Shalaby<sup>3</sup>, G.A. Abdelaleem<sup>1</sup>, K. Madian<sup>1</sup>, K. Ahmed<sup>4</sup>, D. Marzin<sup>5</sup>, G. Benzoni<sup>5</sup> and D.K. Iskander<sup>3</sup></b></p> <p><sup>1</sup>Poultry Diseases Department, Faculty of Veterinary Medicine, Cairo University, Giza, Egypt  <sup>2</sup>Animal Production Department, Faculty of Agriculture, Cairo University, Giza, Egypt,  <sup>3</sup>Animal Health Research Institute, Dokki, Giza, Egypt  <sup>4</sup>Pathology Department, Faculty of Veterinary Medicine, Cairo University, Giza, Egypt, d  <sup>5</sup>Neovia Co. Ltd., Talhouet, Saint Nolf, France.  <a href="mailto:awaad_m_h_h@hotmail.com">awaad_m_h_h@hotmail.com</a></p> <p><b>Abstract:</b> This experiment was to investigate the effect of acidifiers (Protected organic acidifier, CAPacid®, Neovia, France) on gastrointestinal tract (GIT) integrity, zootechnical performance and colonization of <i>Clostridium perfringens</i> (<i>C. perfringens</i>) (type C) and aerobic bacteria in broilers from 1 to 42 days of age under commercial conditions. Obtained results clarified that broiler diets supplemented with acidifier could improve chicken performance (<math>P &lt; 0.05</math>). Also, it decreased the mortality rate, intestinal and cecal colonization of both <i>C. perfringens</i> (naturally present or experimentally induced) and the total aerobic bacteria. The macroscopic and microscopic lesion scores associated with <i>C. perfringens</i> infection were also decreased (<math>P &lt; 0.05</math>). The current study has shown the interest of using protected organic acidifiers into the feed of broiler chickens submitted to <i>C. perfringens</i> infection. In addition, taking in consideration the facts that organic acids do not require withdrawal period, that bird performance are positively affected by their use and that they increase the shelf-life of products, they can make a valuable contribution to flock health and safety of poultry products as food. This may provide a significant tool for the poultry industry in combating the occurrence of intestinal diseases and in reduction of food borne pathogens.</p> <p>[M.H.H. Awaad, A.M. Atta, M. Elmenawey, B. Shalaby, G.A. Abdelaleem, K. Madian, K. Ahmed, D. Marzin, G. Benzoni and D.K. Iskander. <b>S Effect of Acidifiers on Gastrointestinal Tract Integrity, Zootechnical Performance and Colonization of <i>Clostridium Perfringens</i> and Aerobic Bacteria in Broiler Chickens</b>. Journal of American Science 2011;7(4):618-628]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Chickens, Acidifier, <i>Clostridium perfringens</i>, Aerobic bacteria, gastrointestinal tract integrity.</p>	<a href="#">Full Text</a>	88
89	<p><b>Design of optimal fuzzy controller for water level of U-Tube steam generator in nuclear power station</b></p> <p>Hamdi. M. Mousa<sup>*</sup>, Magdy. A. Koutb<sup>**</sup>, Sayed. M. El-Araby<sup>***</sup>, And Elsayed. H. M. Ali<sup>***</sup></p> <p><sup>*</sup>Faculty of Computers and Information, Menoufia University, Egypt  <sup>**</sup>Industrial electronics and control department, Faculty of electronic engineering, Menoufia University, Egypt</p>	<a href="#">Full Text</a>	89

	<p>***Engineering and scientific instruments department, nuclear research center, Atomic energy authority, Cairo, Egypt. <a href="mailto:sayedmahdy@yahoo.com">sayedmahdy@yahoo.com</a></p> <p><b>Abstract:</b> The steam generator is a highly complex, nonlinear and time-varying system and its parameters vary with operating conditions. A method to improve the performance of nuclear steam generator in nuclear power station is introduced. Combination of genetic algorithm technique and fuzzy logic control is carried out. The optimal parameters of fuzzy logic controller are achieved. These parameters include; the membership functions of water level error and changes water level error, the rule base, and the input scaling gains. Steam generator model implemented using MATLAB/SIMULINK. The optimal controller was applied to control the water level of nuclear steam generator and it's compared with conventional controller. Simulation results indicate that the optimal fuzzy controller greatly improves the performance of nuclear steam generator. Moreover the proposed controller is robust to any disturbance related to sudden changes in steam flow rate and water level. Moreover the proposed controller is robust to any disturbance related to load variations.</p> <p>[Hamdi. M. Mousa, Magdy. A. Koutb, Sayed. M. El-Araby, And Elsayed. H. M. Ali. Design of optimal fuzzy controller for water level of U-Tube steam generator in nuclear power station. Journal of American Science 2011;7(4):629-637]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Fuzzy logic control, genetic algorithm, steam generator, nuclear power stations</p>		
90	<p><b>Role of Dietary Fibers in the Management of Diabetes Induced Heart Disease in Male Rats</b></p> <p><b>A. M. El-Wakf<sup>*</sup>, H. A. Hassan, M. M. El-komy and M. M. Amr</b></p> <p>Zoology Department-Faculty of Science-Mansoura University-Mansoura-Egypt  <a href="mailto:mahmoudamr82@yahoo.com">*mahmoudamr82@yahoo.com</a></p> <p><b>Abstract:</b> The present study was conducted to evaluate the effect of oat or wheat bran (as a source of dietary fibers) on the heart disease associated with streptozotocin (STZ)-induced diabetes in male rats. As a result of induction of diabetes, the level of serum glucose and lipids (total lipids, triglycerides, total cholesterol, LDL-C, vLDL-C), as well as activity of lactic dehydrogenase (LDH) and creatinine kinase (CK) were increased, while HDL-C level was decreased. This goes in parallel with a significant reduction in the level of serum insulin and T-homocystein (tHcy). Furthermore, a reduction of total protein and glycogen content in the heart of diabetic rats were recorded. In addition, the diabetic rats exhibited marked trend for increased malondialdehyde and protein carbonyl levels, accompanied with decreased glutathione content in the heart tissue, which together with the other reported abnormalities predict development of heart disease as a result of diabetes. In contrast, feeding diabetic rats on diets supplemented with 7% oat or wheat bran was found to be effective in the management of diabetes-induced changes with the greatest effect being achieved with oat bran administration. Thus, it can be concluded that diet high in plant fibers, particularly oat bran is useful in reducing the development of heart disease associated with diabetes.</p> <p>[A. M. El-Wakf, H. A. Hassan, M. M. El-komy and M. M. Amr. <b>Role of Dietary Fibers in the Management of Diabetes Induced Heart Disease in Male Rats</b>. Journal of American Science 2011;7(4):638-649]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Dietary Fiber; Management; Diabetes; Heart Disease; Rat</p>	<a href="#">Full Text</a>	90
91	<p><b>Field Study on Cadmium in relation to internal parasitic diseases in cultured Nile Tilapia at Kafr El-Sheikh Governorate</b></p> <p><b><sup>1</sup>Eissa, I.A. M.; <sup>2</sup>Mona, S. Zaki; <sup>2</sup>Noor El Deen, A I E, <sup>2</sup>Ibrahim, A. Z. and Osman, K. Abdel Hady</b></p> <p><sup>1</sup>Fish Diseases and Management Dept., Fac. of Vet. Med., Suez Canal Univ., Egypt  <sup>2</sup>Hydrobiology Dept., Vet Division, .National Research Centre, Dokki, Egypt  <a href="mailto:dr_mona_zaki@yahoo.co.uk">dr_mona_zaki@yahoo.co.uk</a></p> <p><b>Abstract:</b> The aim of this study is to explain the relation ship between cadmium pollution and internal parasitic infestation in tilapia fish. The present study was carried out on 400 specimens of Tilapia fish ( <i>Oreochromis</i></p>	<a href="#">Full Text</a>	91

	<p><i>niloticus</i> (<i>O.niloticus</i>) ranged from 20 - 30 cm. While as their body weights were ranged from <math>180 \pm 10</math> g. The clinical signs revealed no pathognomonic abnormalities on the external body surface except in heavily naturally infested fish, represented as respiratory manifestation. The postmortem findings of investigated fish revealed the presence of black spots in different parts of the body in some infested fishes. While, internal organs were appeared anemic with enlargement and congestion. As well as, haemorrhage and ulceration of intestine and stomach mucous membrane, white nodules in posterior kidney. The isolated parasites from examined tilapia were 6 types namely: <i>Enterogyrus cichlidarum</i>, <i>Orientocreadium batrochoides</i>, <i>Heterophidae</i>, <i>Polyonchobothrium</i> sp, <i>Paracamallanas cyathopharynx</i> and <i>Acanthocentis tilapiae</i>. Helminth infestations of <i>O. niloticus</i> in Sidi Salem district fish farms in autumn season were 11 , 8, 1 and 4 % trematodes , nematode , cestode and <i>Acanthocentis tilapiae</i> respectively. Also, in Alirad district fish farms were 9, 4, 1 and 2 % respectively. While, in Meutobeus fish farms were 6 , 3 , 1 and 2 % respectively. The residues of cadmium in water and <i>O. niloticus</i> tissues naturally exposed to cadmium were determined and discussed. The correlation between naturally exposed to cadmium <i>O. niloticus</i> tissues and internal parasitic diseases was studied. Also, cadmium displayed a significant decrease in PCV%, RBCs and Hb while elevation in the level of WBCs, blood glucose, serum AST, ALT, urea and creatinine at Sidi Salem district fish farms decreased in Alirad district fish farms and Metobus District fish farms throughout the periods of study.Besides, the histopathological alterations in different organs of <i>O. niloticus</i> were recorded.</p> <p>[Eissa, I.A. M.; Mona, S. Zaki; Noor El Deen, A I Eand Ibrahim, A Z. <b>Field Study on Cadmium and internal parasitic diseases in cultured Nile Tilapia at Kafr El-Sheikh Governorate</b>. Journal of American Science 2011;7(4):650-660]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> cadmium, <i>O. niloticus</i>, internal parasites, histopathology, clinicopathology</p>		
92	<p><b>New proposed prevertebral approach for turned on contralateral normal C7 as a donor for avulsed brachial plexus</b></p> <p>Ahmed Yehia El-Hoseny<sup>\$</sup> . Mohammed Reda Ahmed<sup>*</sup> , Youssef Hussein<sup>#</sup> .</p> <p>Faculty of Medicine, Zagazig University, * Department of General Surgery, Plastic &amp; Reconstructive unite, \$ Department of Neurosurgery and # Department of Anatomy</p> <p><b>Abstract: Background:</b> Great progress had been made in brachial plexus surgical treatment during recent two decades, however, there are still more challenges need advancing and a lot of work from surgeons and neurosurgeons. <b>Aim:</b> To propose a new surgical approach for neuritization of avulsed brachial plexus (BP). <b>Methods:</b> Anatomical study by dissection of the brachial plexuses on both sides in 6 cadavers (4 males and 2 females) in five steps. <b>Results:</b> The mean value of the length of C7 (<math>5.73\text{Cm} \pm 0.12</math>) was significantly longer than that of C5, C6, C8 and T1 on both sides. Complete C7 length (<math>8.95\text{Cm} \pm 0.04</math>) was significantly longer than that of C7 (<math>7.00\text{Cm} \pm 0.11</math>, <math>P &lt; 0.001</math>). Moreover, in proposed procedure 5 there was significant excesses of the length of complete C7 (<math>0.68\text{Cm} \pm 0.07</math>) when compared with that of proposed procedure 4 and procedure 3 (<math>-0.25\text{Cm} \pm 0.02</math>, <math>-8.95\text{Cm} \pm 0.04</math>, <math>P &lt; 0.001</math>). <b>Conclusion:</b> We proposed by cadaveric dissection a new passageway for turned on complete C7 to neuritize affected Bp just in front of the vertebral column, and we proved the statistical significance of this approach. Moreover, after complete release of C7 from turning around vertebral artery the neuritization will be very lax with extra length.</p> <p>[Ahmed Yehia El-Hoseny, Mohammed Reda Ahmed, Youssef Hussein. <b>New proposed prevertebral approach for turned on contralateral normal C7 as a donor for avulsed brachial plexus</b>. Journal of American Science 2011;7(4):661-668]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> brachial plexus, Nerve graft, prevertebral</p>	<a href="#">Full Text</a>	92
93	<p><b>The Protective Effect of Green Tea Extract against Enrofloxacin Action on the Rat Liver; Histological, Histochemical and Ultrastructural studies</b></p> <p>Amal A. A. El Daly</p> <p>Department of Zoology, Faculty of Science, Benha University, Benha, Egypt <a href="mailto:ml_eldaly@yahoo.com">ml_eldaly@yahoo.com</a></p>	<a href="#">Full Text</a>	93

	<p><b>Abstract:</b> The bioavailability of enrofloxacin (EFX) was determined after single intraperitoneal administration to healthy adult albino rats. The aim of this trial was to evaluate, on what extent, the different doses of the green tea extract (GTE) as an antioxidant encompass a protective effect on the toxicity of EFX. Consequently, the study was carried out in three groups as follows: group1, control animals; group 2, rats medicated only with daily dose of 75mg/kg enrofloxacin for 10 days and group 3, rats receive daily dose of 75mg/kg enrofloxacin and green tea extract for the same period (10 days). The last group was divided into three subgroups; subgroup A, received EFX of the concluding dose plus 1% GTE, subgroup B, received EFX of the same dose plus 1.5% GTE and subgroup C, received EFX of the similar dose plus 3% GTE. After the experimental period, small pieces of the liver tissue were taken and prepared for purpose of the histological, histochemical and electron microscopical examination. The results revealed that enhancement of EFX produces sever alterations in the hepatic tissue. It ascribed disturbances in hepatic architecture besides liver cells appeared hypertrophy correlated with necrotic nuclei. Congested blood sinusoids with leucocytic infiltration were apparent. Hepatocytes induced poor glycogen storage and exhausted proteins. Ultrastructural study demonstrated scattered cytoplasmic organelles after the destructed cell membrane from the burst down of the cell. GTE supplementation partially repairs the toxic effect of EFX and ameliorates the hepatic tissue especially when consumed by higher doses. Cytoplasmic glycogen and protein come again too increased. The fine structure manifested more or less intact hepatocytes through restored organelles constituents especially numerous profiles of granular endoplasmic reticulum, few lysosomes, normal glycogen deposits, euchromatic nuclei and distinct nucleoli as well as few lipid droplets in the cytoplasm. It was concluded that GTE is an important appropriate anti-oxidant improving the EFX toxicity at the altitude of the different doses however more improvement was observed after the consumption of higher ones.</p> <p>[Amal A. A. El Daly. <b>The Protective Effect of Green Tea Extract against Enrofloxacin Action on the Rat Liver; Histological, Histochemical and Ultrastructural studies.</b> Journal of American Science 2011;7(4):669-679]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Green tea, Enrofloxacin, rat Liver, Histology, Histochemistry, Ultrastructure</p>	
94	<p><b>Sustainable Agriculture Extension System in Khouzesan Province, Iran (Goals, Contents, Organization and Extension agents)</b></p> <p>Ahmad Reza Ommani</p> <p>Assistant Professor Department of Agricultural Management, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran. <a href="mailto:Ommani75451@yahoo.com">Ommani75451@yahoo.com</a></p> <p><b>Abstract:</b> The purpose of this study was determining favorable goals and contents of sustainable agricultural extension system in Khouzesan province, Iran. Extension experts of Agricultural-Jihad organization in Khouzesan province were considered as a statistical population (N=120). All individuals were investigated. After confirm the validity of the instrument by panel of experts, to determine the reliability coefficient using Cronbach alpha coefficients were obtained for all sections of the questionnaire over 0.7 were calculated. Method of research was descriptive and correlative. Based on the results, the most important goals of extension system for supporting sustainable agriculture were: increasing knowledge and skills of sustainability, increasing productivity and efficiency, health development, technology transfer and development of food security. Also, the results that indicated the most important extension contents were: development of organic farming, development of biological control, food security contents, development of integrated management and considering crop yield. In addition, the most important characteristics that have been recommended and agricultural extension organizations must consider were: interaction communication, systematic management, occupations quality, and horizontal communication. Based on the results, the most important experts characteristics were: skills of information presentation, knowledge of adult education, knowledge of information technology, and knowledge about sustainable agriculture. Based on regression the results also showed that favorable goals, contents, organization and extension agents can explain 48% of variance of dimensions of sustainable agriculture.</p> <p>[Ahmad Reza Ommani. <b>Sustainable Agriculture Extension System in Khouzesan Province, Iran (Goals, Contents, Organization and Extension agents).</b> Journal of American Science 2011;7(4):680-684]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Extension system, sustainable agriculture, Extension expert</p>	<p><a href="#">Full Text</a></p> <p>94</p>

95	<p><b>Educational Needs of Watershed Experts (WEs) of Khouzestan Province, Iran Regarding of Sustainable Water Resources Management (SWRM) in Agriculture</b></p> <p>Ahmad Reza Ommami<sup>1</sup> and Azadeh N. Noorivandi<sup>2</sup></p> <p><sup>1</sup>Assistant Professor Department of Agricultural Management, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran, <a href="mailto:Ommami75451@yahoo.com">Ommami75451@yahoo.com</a></p> <p><sup>2</sup> Department of Agricultural Management, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran, <a href="mailto:noorivandi_a@yahoo.com">noorivandi_a@yahoo.com</a></p> <p><b>Abstract:</b> The purpose of this research was determining educational needs and perceptions of Watershed Experts (WEs) regarding <u>sustainable water resources management (SWRM) in agriculture</u>. The research method was descriptive research. Total population of experts in the study included all (watershed experts N=79) of Agricultural-Jihad Organization of Khuzestan Province, Iran. The return rate questionnaires was 92.4% (N=73). Based on the results approximately, 75.4% of respondents had moderate perceptions about SWRM in agriculture. Ranking based on coefficient of variation indicated that the six most important training needs of watershed experts were: (1) New irrigation systems, (2) Identifying appropriate cultivation models, (3) Integrated insect pest management, (4) Water productivity and efficiency in agriculture, (5) Recycling farm waste , and (6) Crop rotations. In-service training programs play a critical role in reinforcing staff capability, as well as renewing their skills. The organizations and institutes which are responsible for in-service training both for agricultural experts must consider training needs of them.</p> <p>[Ahmad Reza Ommami. <b>Educational Needs of Watershed Experts (WEs) of Khouzestan Province, Iran Regarding of Sustainable Water Resources Management (SWRM) in Agriculture</b>. Journal of American Science 2011;7(4):685-689]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Watershed Experts, Sustainable water management, Khouzestan</p>	<a href="#">Full Text</a>	95
96	<p><b>Infrastructure Resource Planning in Modern Power System</b></p> <p>Mohammad Sadegh Javadi <sup>1</sup>, Morteza Taherkhani <sup>1</sup> Amin Javadinasab <sup>1</sup></p> <p><sup>1</sup>Department of Electrical and Electronic Engineering, Islamic Azad University, Shoushtar Branch, Shoushtar, Iran <a href="mailto:msjavadi@gmail.com">msjavadi@gmail.com</a></p> <p><b>Abstract:</b> Generation Expansion Planning (GEP) is one of the most important issues in long-term power system planning. In from past, investigators noticed to GEP and supply of energy. In power system planning, generation expansion planning is performed for 5-years planning horizon or more. There are two main objective functions in GEP. First is the minimization of investment cost and another one is the maximization of reliability. GEP use future likeable engineering economics function, in order to drive certain indicator. Supply of fuel problem is one of the most important of effective factors for result. For this reason, Some times GEP and fuel supply center go hand-in-hand. In this case, construction and operation cost of transmission network add to power system costs. This paper presents the simultaneous generation expansion planning with Natural Gas Expansion Planning (NGEP), as the fuel for generation units</p> <p>[Mohammad Sadegh Javadi, Morteza Taherkhani, Amin Javadinasab, Infrastructure Resource Planning in Modern Power System. Journal of American Science 2011;7(4):690-696]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Combines Cycle Generation Technology (CCGT), Generation Expansion Planning (GEP), Load Dispatch Planning, Natural Gas Expansion Planning (NGEP)</p>	<a href="#">Full Text</a>	96
97	<p><b>Effect of Different Concentrations of Benzalkonium Chloride on the Cornea</b></p> <p><b>Eman M. Aly</b></p> <p>Biophysics and Laser Science Unit, Research Institute of Ophthalmology, Giza, Egypt. <a href="mailto:e.alay@hotmail.com">e.alay@hotmail.com</a></p>	<a href="#">Full Text</a>	97



	<p><b>Abstract:</b> Aim of the work: The overall objective of this study is to evaluate the effect of benzalkonium chloride (BAK) on the conformational characteristics of the cornea. Materials and methods: New Zealand white rabbits were used in this study for application of different concentration of BAK (0.005%, 0.01% and 0.02%) for different periods (4, 8, 12 and 16 days). Results: The study reports the corneal structure alterations that may be induced as a result of BAK applications that were studied by Fourier transform infrared spectroscopy (FTIR). The resulting IR spectra were analyzed using the band enhancement procedure. The obtained data clearly indicate that there are different structural and conformational changes as the method of BAK applications.</p> <p>[Eman M. Aly. <b>Effect of Different Concentrations of Benzalkonium Chloride on the Cornea.</b> Journal of American Science 2011;7(4):697-703]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Benzalkonium chloride, Eye, Cornea, FTIR, Rabbits</p>		
98	<p style="text-align: center;"><b>Calibration of UVA Radiometers</b></p> <p style="text-align: center;">Sameh M. Reda</p> <p style="text-align: center;">Photometry and Radiometry Division National Institute for Standards (NIS), EGYPT, <a href="mailto:egyreda@hotmail.com">egyreda@hotmail.com</a></p> <p><b>Abstract:</b> A general methodology of the calibration of broad band ultraviolet (UVA) radiometers is considered and categorized in this paper, based on the concepts of comparison method of effective irradiance responsivity. Also an example of calibration set-up and uncertainty budget presented.</p> <p>[Sameh M. Reda. <b>Calibration of UVA Radiometers.</b> Journal of American Science 2011;7(4):704-706]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Radiometry, Radiometer calibration, UVA radiometer.</p>	<a href="#">Full Text</a>	98
99	<p style="text-align: center;"><b>Comparative Study of Structural Systems for Tall Buildings</b></p> <p style="text-align: center;">N. F. El-Leithy<sup>1</sup>, M. M. Hussein<sup>2*</sup> and W. A. Attia<sup>3</sup></p> <p style="text-align: center;"><sup>1</sup> Engineer, Structural Engineer.</p> <p style="text-align: center;"><sup>2</sup>Structural Engineering Department, Faculty of Engineering, Cairo University, Giza, Egypt</p> <p style="text-align: center;"><sup>3</sup> Structural Engineering Departments, Faculty of Engineering, Cairo University, Giza, Egypt</p> <p><b>Abstract:</b> An investigation has been carried out to examine the most common structural systems that are used for reinforced concrete tall buildings under the action of gravity and wind loads. These systems include “Rigid Frame”, “Shear Wall/Central Core”, “Wall-Frame Interaction”, “Outrigger”, and “Tube in Tube”. The basic modeling technique and assumptions are made by “ETABS” Program, in 3-D modeling. Design considerations are made according to “ACI 318-05” Code and “ASCE 7-05” Standard. This comparative analysis has been aimed to select the optimal structural system for a certain building height. The structural efficiency is measured by the volume of concrete of main elements, structural period, and base shear values. The recommendations for each structural system are based upon limiting the wind drift of the structure, minimizing the cost of wind force resisting elements, and increasing the lateral stiffness.</p> <p>[N. F. El-Leithy, M. M. Hussein and W. A. Attia. <b>Comparative Study of Structural Systems for Tall Buildings.</b> Journal of American Science 2011;7(4):707-719]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Tall buildings; structural systems; wind loads; and drift control</p>	<a href="#">Full Text</a>	99
100	<p style="text-align: center;"><b>Adult characteristics: The role of these features in their education</b></p> <p style="text-align: center;"><sup>1</sup> Azita Zamani, <sup>2</sup> Nahideh Erfanirad</p> <p style="text-align: center;"><sup>1, 2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran</p> <p style="text-align: center;">*Corresponding author: mehran11070@yahoo.com</p> <p><b>Abstract:</b> adult who is able to recognize their needs. He is who knows what will. Refers to individual adults in</p>	<a href="#">Full Text</a>	100

	<p>their lives cross and understand their responsibilities and has accepted the role is social. Adult learners are often those that distinguish each other and have many different targets at the same time and will follow a common challenge to fulfill the goals of building self motivation vectors as educational materials to learn and use the forge. In the past, usually one of the obstacles in the way of learning and development of adult education was being inflexible and time courses were programs. But now most countries have to consider that the speed limit of time and learning ability and facilities must be adults. Flexibility in time means that not only should the time classes and programs for adults is appropriate, but necessary facilities should be provided for independent study.</p> <p>[Azita Zamani and Nahideh Erfanirad. <b>Adult characteristics: The role of these features in their education.</b> Journal of American Science 2011;7(4): 720-725]. (ISSN: 1545-1003).<a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> adult education, learning</p>		
101	<p><b>Evaluation of antioxidant and antibacterial activities of Egyptian <i>Maydis stigma</i> (<i>Zea mays</i> hairs) rich in some bioactive constituents</b></p> <p>Eman, A. Alam</p> <p>Botany Department, National Research Centre, Dokki, Giza, Egypt. <a href="mailto:lalalalala2011@yahoo.com">lalalalala2011@yahoo.com</a></p> <p><b>Abstract:</b> The main aim of this research work is to evaluate antioxidant and antibacterial activities of Egyptian <i>Maydis stigma</i> (<i>Zea mays</i> hairs" corn silk") rich in some bioactive constituents. Antioxidant activity of ethanolic extract of both upper parts of corn silk (dark brown parts, exposed to the air) and lower parts (light yellow parts, not exposed to the air) was determined spectrophotometrically using total antioxidant activity and DPPH scavenging activity methods. It was found that upper parts were found to have the highest total antioxidant capacity (2.735 mg/g GA equivalents). Regarding DPPH scavenging activity, it was found that upper parts were found to have the highest DPPH scavenging activity (IC<sub>50</sub> = 0.704 mg/ml). Antibacterial activity of ethanolic extract of both upper and lower parts of corn silk was screened against six human pathogenic bacterial species (<i>Pseudomonas aeruginosa</i>, <i>Klebsiella pneumoniae</i>, <i>Staphylococcus aureus</i>, <i>Streptococcus pneumoniae</i>, <i>Escherichia coli</i> and <i>Streptococcus pyogenes</i>) by disk diffusion assay. The pattern of inhibition, activity index and proportion index were studied. It was found that both upper and lower parts of corn silk have no effect on bacterial species under investigation. Total phenolics, total anthraquinones and total flavonoids were estimated, in these regard, upper parts contain more amounts of these phytochemicals (180 µg GAE/g F.W., 17.22 µg/g F.W. and 119.47 µg/g F.W. respectively) than lower parts of corn silk (151.33 µg GAE/g F.W., 8.61 µg/g F.W. and 101.66 µg/g F.W. respectively).</p> <p>[Eman, A. Alam . Evaluation of antioxidant and antibacterial activities of Egyptian <i>Maydis stigma</i> (<i>Zea mays</i> hairs) rich in some bioactive constituents Journal of American Science 2011;7(4):726-729]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Corn silk, Antioxidant activity, Antibacterial activity, Phenolics, Anthraquinones, Flavonoids</p>	<a href="#">Full Text</a>	101
102	<p><b>The Egyptian Nursing Student's Perceptive view about an Objective Structured Clinical Examination (OSCE)</b></p> <p><b>Ghadah A. Mahmoud<sup>1*</sup> and Manal F. Mostafa<sup>2</sup></b></p> <p><sup>1</sup> Obstetrics and Gynecological Nursing Dept., Faculty of Nursing, Assiut University, Egypt.  <sup>2</sup> Obstetrics and Gynecological Nursing Dept., Faculty of Nursing, Assiut University, Egypt.  <a href="mailto:Ghadah_omar2008@yahoo.com">*Ghadah_omar2008@yahoo.com</a></p> <p><b>Abstract:</b> The aim of this study was to assess the third year nursing student's perception about an OSCE in Obstetrics and Gynecological Nursing. A descriptive design was utilized for collecting the data that are necessary to answer the research question. The sample consisted of 100 students who finished the 3<sup>rd</sup> year clinical teaching course of Obstetrics and Gynecological Nursing and were evaluated by an OSCE. The results of this study explored that more than one third of the students considered the announcement of the date and the place of examination were very good (39% and 38%, respectively). As regards the format of OSCE, the study identified that 41% of the students considered the revision done before examination was excellent. The majority of the</p>	<a href="#">Full Text</a>	102

	<p>students considered the quality of examination was excellent. Concerning the difficulties in time management during OSCE, more than half of the students (55%) were agreed. As regards the presence of emotional stress, more than two thirds of the students (77%) were agreed. In the light of the present study findings, it can be concluded that there is more need for careful preparation and organization of OSCE. The majority of the students appreciate the format of OSCE. The study has also highlighted that there are more need for training the students on time management and relieving their emotional stress during implementation of OSCE. It is essential to consider the recommended use of OSCE prescribed within wider context in nursing curriculum evaluation models. A larger study is needed to establish the effectiveness of OSCE within nursing education programs. An exploration of how successfully students transfer into clinical practice and to explore the validity and reliability of OSCE.</p> <p>[Ghadah A. Mahmoud and Manal F. Mostafa. <b>The Egyptian Nursing Student's Perceptive view about an Objective Structured Clinical Examination (OSCE)</b>. Journal of American Science 2011;7(4):730-738]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> OSCE, Validity, Reliability, Competence, ILOs</p>		
103	<p style="text-align: center;"><b>Impact of Sirolimus Vs Cyclosporin A Immunosuppressive Drug in Dog's Alveolar Bone</b></p> <p style="text-align: center;">Mohamad E Helal<sup>1*</sup> and Mohamed Zaghloul<sup>2</sup></p> <p style="text-align: center;"><sup>1</sup> Oral Biology Department, Faculty of Dentistry, Mansoura University, Egypt.  <sup>2</sup> Oral Surgery Department, Faculty of Dentistry, Mansoura University, Egypt.  <a href="mailto:*mhelal2005@yahoo.com">*mhelal2005@yahoo.com</a></p> <p><b>Abstract:</b> Sirolimus is a modern immunosuppressive drug that has a novel mechanism of action as it improves the patients' condition receiving transplant. This study aimed to assess the effects of sirolimus Vs cyclosporin A (CsA) immunosuppressive drug on teeth's alveolar bone. Fifteen Mongrel dogs were used in this study. They were classified into three equal groups. The 1st group is considered as control. The 2nd and 3rd groups were subjected to cyclosporine A and sirolimus treatment protocol, respectively up to 45 days. The parameters involved were 1) body weight (BW), 2) biochemical markers of serum osteocalcin (OC) and alkaline phosphatase (APH) levels. 3) Densitometric analysis for the mandibular alveolar bone at canine area using dual energy X-ray absorptiometry. 4) All animals were euthanized, mandibles were dissected and specimens taken from the canine areas (canine and its supporting bone) and specimens were processed to examine the alveolar bone changes at the end of the experiment and 5) histomorphometric analysis using Masson's trichrome stain evaluated the width of periodontal ligament. Results obtained revealed a significant decrease of both body weight and alveolar bone mineral density. Meanwhile, there were significant increases of periodontal ligament width, serum OC and APH. We concluded that both sirolimus and CsA drugs have adverse effects on the alveolar bone quality. Also, the sirolimus produced the worst effects regarding of BW, BMD of teeth's alveolar bone, serum OC and APH levels with evidence of osteoporosis.</p> <p>[Mohamad E Helal and Mohamed Zaghloul. <b>Impact of Sirolimus Vs Cyclosporin A Immunosuppressive Drug in Dog's Alveolar Bone</b>. Journal of American Science 2011;7(4):739-744]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Alveolar bone; Osteoporosis; Bone mineral density; Sirolimus; Cyclosporin A</p>	<a href="#">Full Text</a>	103
104	<p style="text-align: center;"><b>Antibacterial Activity of Methanolic Extract of Dominant Marine Alga (<i>Padina pavonia</i>) of Tolmeta Coasts, Libya</b></p> <p style="text-align: center;"><sup>1</sup>Eisha Soliman El-Fatimy and Alaa. Abdel-Moneim Said<sup>2*</sup></p> <p style="text-align: center;"><sup>2</sup>Botany Department, Faculty of Education, Ghemines branch, Garyounis University, Libya.  <sup>*</sup> Botany Department, Faculty of Science, Garyounis University, Benghazi, Libya  <a href="mailto:Laloshsm@yahoo.com">Laloshsm@yahoo.com</a>; <a href="mailto:alaasaidalaasaid@yahoo.com">alaasaidalaasaid@yahoo.com</a>.</p> <p><b>Abstract:</b> This study mainly aimed to identify the marine algae of Tolmeta coasts and evaluate the antibacterial activity of the most dominant species (<i>Padina pavonia</i>) as compared with some famous antibiotics. During many sampling visits at 2009, Thirty four marine algal species (26 genera) were collected and identified at Tolmeta</p>	<a href="#">Full Text</a>	104

	<p>coasts (150 Km. eastern north Benghazi city). Two species (5.88%) of the collected algae (<i>Lyngbia</i> and <i>Rivularia</i>) were belonging to Cyanophyta, Six species (17.65%) belong to Chlorophyta, thirteen species (38.24%) belonging to Phaeophyta (with special reference to genera <i>Padina</i> and <i>Cystoseira</i>) and thirteen species (38.24%) belonging to Rhodophyta. The R/P ratio was 1.00 which indicated the rough weather of this area. <i>Padina pavonia</i> was the most dominant species at all samples, methanolic crude extract (at cold and 24 h.) were tested against <i>Escherichia coli</i> and <i>Staphylococcus aureus</i> bacteria and matched with some famous antibiotics. All of the treatments were affected <i>Escherichia coli</i>, they could statistically ranked dissentingly as Ci &gt; E15 &gt; Sxt at the first rank and Te30 &gt; <i>Padina</i> extract at the second rank while P10 came at the third rank with significant values. Meanwhile, <i>Staphylococcus aureus</i> was affected only by E15 antibiotic.</p> <p>[Eisha Soliman El-Fatimy and Alaa. Abdel-Moneim Said. <b>Antibacterial Activity of Methanolic Extract of Dominant Marine Alga (<i>Padina pavonia</i>) of Tolmeta Coasts, Libya.</b> Journal of American Science 2011;7(4):745-751]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Marine algae, R/P ratio, <i>Padina pavonia</i>, <i>Escherichia coli</i> and <i>Staphylococcus aureus</i></p>		
105	<p><b>Evaluation of Biological Compounds of Streptomyces Species for Control of some Fungal Diseases</b></p> <p><b>Hassan , A. A.<sup>1</sup>; El-Barawy, A.M.<sup>*2</sup> and El Mokhtar M. Nahed <sup>1</sup></b></p> <p><sup>1</sup>Mycology Department and <sup>2</sup>Pharmacology Unit, Animal Health Research Institute, Dokki, Giza, Egypt  <a href="mailto:elbarawy4@yahoo.com">*elbarawy4@yahoo.com</a></p> <p><b>Abstract:</b> Fifty cases in cattle farm at Giza governorate were investigated. Some animals were suffered from clinical manifestations such as growth retardation, refused feeds, diarrhea, skin patches, cough and nasal discharge. Hundred samples of air, water supply and feeds including tibn, hay and processed feeds (20 of each) and Sixty samples of feces (of diarrheic animals) skin and nasal swabs (20 of each) were collected for fungal examination. The results revealed that 9 genera of moulds and 2 genera of yeasts were recovered from feed samples. The most predominant isolates of all types of feeds were the mould of genus <i>Aspergillus</i> particularly <i>A. flavus</i> (95%). Also, members of genus <i>Aspergillus</i> were predominantly recovered from most of samples of discharges as it were recovered (47.0 %). On the other hand, only one species of moulds was isolated from the skin scraping associated with skin lesion (<i>Trichophyton sp.</i>). Most of isolated <i>A. flavus</i> and <i>A. ochraceus</i> from animal feeds in diseased farms produced significant levels of aflatoxins and ochratoxins, respectively. The isolated <i>A. flavus</i> and <i>A. ochraceus</i> from tibn yielded a higher mean levels of aflatoxins and ochratoxins (2700 and 3250 ppb), respectively. The antifungal effects of stationary or the exponential culture filtrate obtained from the strain of <i>Streptomyces sp.</i> were evaluated against the isolated pathogenic fungi. The results indicated that the stationary culture filtrate possessed a higher antifungal potential than the exponential culture filtrate. Where, the filtrate of the stationary phase of <i>Streptomyces sp.</i> yielded significantly wider range of antifungal activity zones ranged from 7±0.69 to 11±1.41 mm diameter compared with antifungal activity zone of the culture filtrate of the exponential phase which ranged from 5±0.64 to 8±1.58 mm diameter in comparison with benzoic acid as control which ranged from 3±0.55 to 8±0.83 mm diameter (P &lt; 0.05). The production of chitinase (6.0 u/mg protein) and -1, 3-glucanase (0.82- 0.35 u/mg protein) enzymes by <i>Streptomyces</i> were related to fungal growth inhibition and the biological control of fungal pathogens was possible because of the ability of <i>Streptomyces</i> to degrade fungal cell walls. MIC<sub>50-90</sub> of tested antimycotic drugs (Nystatin, Ketoconazole and Itraconazole) as well as <i>Streptomyces</i> extract were ranged from 0.75±0.05 to 4±0.81 µg/ml against isolated yeasts (<i>Candida albicans</i> and <i>Rhodotorulla sp.</i>). <i>Streptomyces</i> exponential and stationary culture filtrate as well as its extract could be used as antifungal agent. [Hassan , A. A.; El-Barawy, A. M. and El Mokhtar M. Nahed. <b>Evaluation of biological compounds of Streptomyces species for control of some fungal diseases.</b> Journal of American Science 2011;7(4):752-760]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Biological compounds ,Streptomyces species, fungal diseases, moulds, yeasts, <i>Aspergillus</i>, <i>Trichophyton</i>, aflatoxins and ochratoxins, antifungal activity, stationary, exponential, chitinase and glucanase</p>	<a href="#">Full Text</a>	105
106	<p><b>Certain Epidemiological Aspects of Aeromonas hydrophila Infection in Chickens</b></p> <p><b>M. H. H. Awaad<sup>1</sup>, M. E. Hatem<sup>2</sup>, Wafaa A. Abd El-Ghany<sup>*1</sup>, Asia El-Sawy<sup>3</sup> and A. Fathi<sup>2</sup></b></p>	<a href="#">Full Text</a>	106

	<p><sup>1</sup>Poultry Diseases Department, Faculty of Veterinary Medicine, Cairo University, Egypt  <sup>2</sup>Microbiology Department, Faculty of Veterinary Medicine, Cairo University, Egypt  <sup>3</sup>Animal Health Research Institute, Cairo, Egypt  <a href="mailto:Wafaa.ghany@yahoo.com">*Wafaa.ghany@yahoo.com</a></p> <p><b>Abstract:</b> <i>Aeromonas hydrophila</i> (<i>A. hydrophila</i>) is one of enteric poultry pathogens of public health importance. This work was designed to investigate certain epidemiological aspects of <i>A. hydrophila</i> including its viability, cycle of infection and its pathogenicity to chicks. A gentamicin resistant <i>A. hydrophila</i> strain (GR <i>A. hydrophila</i> strain) was prepared. The results showed that GR <i>A. hydrophila</i> survived in water for 26 days at room temperature and also it could be persist in chicken crates, feces, ration, saw dust and straw for 11, 9, 23, 22 and 17 days, respectively. GR <i>A. hydrophila</i> could induce 8.3% embryonic mortality after dipping of the eggs in infected broth culture. Hatched chicks from GR <i>A. hydrophila</i> infected eggs showed mortalities reaching 13.3 and 1.7 % during 1<sup>st</sup> and 2<sup>nd</sup> week post hatching, respectively. Survived infected chicks exhibited signs and lesions of omphalitis, enteritis and septicaemia and depression in heir weight gain. The rate of GR <i>A. hydrophila</i> re-isolation from dead embryos reached 100%, while it was 95.6, 26, 8.7, 4.4, 2.2 and 4.3% from intestine, liver, heart, spleen, kidney and lung, respectively in sacrificed survivors. Fecal shedding of GR <i>A. hydrophila</i> in chicken breeders revealed higher percentage in orally infected birds than subcutaneously infected ones. Addition of probiotic to the ration of orally infected group resulted in lowering the shedding rate. Re-isolation of the organism from egg shells reached 12 % in orally infected breeders compared to 4 % in orally infected probiotic treated birds. Samples taken from reproductive and internal organs of parent chicken hens were negative for GR <i>A. hydrophila</i> re-isolation. In conclusion; GR <i>A. hydrophila</i> survives for several weeks in contaminated water, ration and litter. The organism may infect birds by oral route and can colonize intestine. GR <i>A. hydrophila</i> is not congenitally transferred as ovary and oviduct do not play a role in dissemination of <i>A. hydrophila</i> infection. Addition of probiotic to the ration can reduce fecal shedding rate as well as re-isolation of <i>A. hydrophila</i> from the egg shells.  [M. H. H. Awaad, M. E. Hatem, Wafaa A. Abd El-Ghany, Asia El-Sawy and A. Fathi. <b>Certain Epidemiological Aspects of <i>Aeromonas hydrophila</i> Infection in Chickens</b>. Journal of American Science 2011;7(4):761-770]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key Words:</b> <i>Aeromonas hydrophila</i>, Chickens, Survival, Transmission</p>	
107	<p><b>Synthesis and Biochemical Evaluation of Some Substituted Phthalazines</b></p> <p><b>Nahed F. Abd El-Ghaffar<sup>*1</sup>, Mona A. Mohamed<sup>2</sup>, Hala M.Ghanem<sup>3</sup> and Heba M. Zaki<sup>1</sup></b></p> <p><sup>1</sup>Chemistry Department, <sup>2</sup>Biochemistry Division, Faculty of Science, Al-Azhar University, Egypt.  <sup>3</sup>Biochemistry Department, Faculty of Science, Ain-Shams University, Egypt.  <a href="mailto:mabdelgelel@gmail.com">*mabdelgelel@gmail.com</a></p> <p><b>Abstract:</b> The chemistry of phthalazine derivatives has been of increasing interest since many of these compounds have found chemotherapeutic applications. So this study aims to synthesize series of phthalazine derivatives, and investigate the antihyperglycemic, antihyperlipidemic and antibacterial activities of these derivatives. The influence of some synthesized phthalazine derivatives administered orally was studied in diabetic rats. Rats were divided into 5 equal groups. Group I: control rats. Group II: diabetic rats serving as a reference group for the treated groups. Groups III, IV and V: diabetic rats received a daily oral dose of 3mg/kg from each tested derivative for 15 days. At the end of the experimental period, serum levels of glucose, lipid profile and non-esterified fatty acids were assayed. Other phthalazine derivatives were tested against four pathogenic bacterial strains. The tested derivatives improved significantly serum levels of glucose, lipid profile and free fatty acids. Some phthalazine derivatives exhibited interesting high activity against Gram +ve bacteria than those of Gram -ve. Conclusion: This study reports interest findings that the tested phthalazine derivatives have antihyperglycemic and antihyperlipidemic effects at the adopted sublethal dose. The type of chemical derivatization of phthalazine confers glucose and lipid lowering activities as well as antibacterial activity.  [Nahed F. Abd El-Ghaffar, Mona A. Mohamed, Hala M.Ghanem and Heba M. Zaki. <b>Synthesis and Biochemical Evaluation of Some Substituted Phthalazines</b>. Journal of American Science 2011;7(4):771-781]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p>	<p><a href="#">Full Text</a></p> <p>107</p>



	<p><b>Keywords:</b> <i>Phthalazinone, Chlorophthalazine, Thiophthalazine, Diabetes, Triacylglycerol, fatty acids.</i></p>		
108	<p align="center"><b>Ocular Findings and Management in Egyptian Children with Down Syndrome</b></p> <p><b>*Hanan H. Afifi<sup>1</sup>; Amira A. Abdel Azeem<sup>2</sup>; Hala T. El-Bassyouni<sup>1</sup>; Moataz E. Gheith<sup>3</sup> and Akmal Rizk<sup>4</sup>.</b></p> <p align="center">Clinical Genetics Department<sup>1</sup>, National Research Centre. Ophthalmogenetics<sup>2</sup>, Ophthalmology<sup>3</sup>, Pediatric Ophthalmology<sup>4</sup> Departments, Research Institute of Ophthalmology, Cairo, Egypt *hhafifi@gmail.com</p> <p><b>Abstract:</b> Background: Ocular disorders in Down syndrome (DS) are not uncommon. However their frequency in Egyptian population is not well defined. Methods: Ninety Egyptian children with Down syndrome (3 months to 10 years old) were diagnosed both clinically and cytogenetically and followed up for three years. The ophthalmic examination included, evaluation of ocular motility, assessment of eye alignment, using Hirschberg test, portable slit lamp biomicroscopy, cycloplegic retinoscopy, ophthalmoscopy and ultrasound if needed. Results: Fifty two patients (57.8%) with one or more ophthalmological findings were diagnosed in the first visit. Refractive errors (41%) were the most common, with hypermetropia being the most frequent. Strabismus (14.4%) was the next common ocular disorder, followed by nasolacrimal duct obstruction (10%), conjunctivitis and congenital cataract each of them represented (5.6%), blepharoconjunctivitis (4.4%), nystagmus (3.3%) and tilted optic disc (2.2%). However, Brushfield spots were not observed among these patients. There were 12 more ocular disorders detected on follow up. Thirty six patients (40%) had congenital heart defects and 86.1% of them had associated ocular disorders. Conclusions: More than half of patients with Down syndrome had ophthalmic abnormalities. Patients with congenital heart defects had possible association with ophthalmic disorders especially myopia. Ocular examination and management for patients with DS are essential to improve their quality of life. [Hanan H. Afifi; Amira A. Abdel Azeem; Hala T. El-Bassyouni; Moataz E. Gheith and Akmal Rizk. Ocular Findings and Management in Egyptian Children with Down Syndrome. Journal of American Science 2011;7(4):782-788]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Down syndrome, Ocular disorders, Cardiac anomalies, Egypt.</p>	<a href="#">Full Text</a>	108
109	<p align="center"><b>Dual Construction of Developable Ruled Surface</b></p> <p align="center"><b>*Nassar H. Abdel-All, R.A.Huesien, and Ali Abdela Ali</b></p> <p align="center">Mathematics Department, Faculty of Science, Assiut University Assiut 71516, Egypt *<a href="mailto:nhabdeal2002@yahoo.com">nhabdeal2002@yahoo.com</a></p> <p><b>Abstract:</b> In this paper, some of developable ruled surfaces are constructed using the dual representation of plane curves through a dual unit space curve on the dual unite sphere. These surfaces are studied and plotted. [Nassar H. Abdel-All, R.A.Huesien, and Ali Abdela Ali. <b>Dual construction of Developable Ruled Surface.</b> Journal of American Science 2011;7(4):789-793]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Dual Construction; Developable; Surface</p>	<a href="#">Full Text</a>	109
110	<p align="center"><b>Extractive Spectrophotometric Determination of some Drugs Through Ion-Pair Complex Formation with Thiocyanate wnd Cobalt (II) or Molybdenum (V)</b></p> <p align="center"><b>Ragaa El-Shiekh <sup>(b)</sup>, Magda Akl* <sup>(a)</sup>, Ayman Gouda<sup>(b)</sup> and Wael Ali <sup>(a)</sup></b></p> <p align="center"><sup>a</sup> Chemistry Department, Faculty of Science ,Mansoura University, Mansoura, Egypt <sup>b</sup> Chemistry Department, Faculty of Science ,Zagazig University, Zagazig, Egypt *<a href="mailto:magdaakl@yahoo.com">magdaakl@yahoo.com</a></p> <p><b>Abstract:</b> Two rapid, simple and sensitive extractive specrophotometric methods has been developed for the assay of Hyoscine butyle bromide (HBB), losartan potassium (LSR) and Sertaline HCl (SER) in bulk and in their pharmaceutical formulations. The proposed methods depend upon the reaction of cobalt(II)–thiocyanate (method</p>	<a href="#">Full Text</a>	110

	<p>A) and molybdenum(V)–thiocyanate ions (method B) with the cited drugs to form stable ion-pair complexes which is extractable with an n-butanol–dichloromethane solvent mixture (3.5:6.5) and methylene chloride for methods A and B, respectively. The blue and orange red color complexes are determined either colorimetrically at max 625,627 and 630 nm for HBB,SER and LSR respectively (using method A) and 478 , 465 and 468 nm for HBB,SER and LSR respectively (using method B). The concentration range is 20 400 and 5 50 µg mL<sup>-1</sup> for methods A and B, respectively. The proposed method was successfully applied for the determination of the studied drugs in pure and pharmaceutical formulations applying the standard additions technique and the results obtained were in good agreement with those obtained by the official method.</p> <p>[Ragaa El-Shiekh, Magda Akl, Ayman Gouda and Wael Ali. <b>Extractive Spectrophotometric Determination of some Drugs Through Ion-Pair Complex Formation with Thiocyanate wnd Cobalt (II) or Molybdenum (V).</b> Journal of American Science 2011;7(4):794-807]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Hyoscine butyle bromide; losartan potassium ;Sertaline HCl ; Ion-pair complexes; Specrophotometry; Pharmaceuatical formulations</p>		
111	<p><b>Causes and Types of Conflict and Resolution Strategies among Nursing Students: A Comparative Study between Two Cultures</b></p> <p>Samah F. Fakhry<sup>*1</sup> QUOTE <b>Fakhry<sup>1</sup></b> and Nevein A. Abou El Hassan<sup>2</sup> QUOTE <b>Hassan<sup>2</sup></b></p> <p><sup>1</sup>Nursing Administration Department. Faculty of Nursing. Ain Shams University, Egypt.  <sup>2</sup>Nursing administration Department. Faculty of Nursing. Ain Shams University. Egypt and Nursing Department. Beirut Arab University, Lebanon.  <a href="mailto:samah_taher75@yahoo.com">*samah_taher75@yahoo.com</a></p> <p><b>Abstract:</b> Purpose: To compare the causes, types, and applied conflict resolutions strategies among nursing students at Ain-Shams University in Egypt and Beirut Arab University in Lebanon. Methods: Design: This comparative cross-sectional study was conducted on a convenience sample of 202 Egyptian and 75 Lebanese nursing students during the academic year 2009/2010. Data collection was through a self-administered form including a questionnaire for conflict causes (Cronbach alpha coefficient =0.955) and the conflict strategies inventory (Cronbach alpha coefficient =0.829). Findings: Time pressure was the most common cause of conflict among Egyptian (42.6%) and Lebanese (42.7%) students, and the intra-person type was the most prevalent among them, 32.2% and 17.3%, respectively. Egyptians had more use of accommodating (p=0.02), collaborating (p=0.006), competing (p=0.007), and avoiding (p=0.006) strategies. The competing, compromising, and avoiding strategies had weak positive statistically significant correlations with all types of conflict in the Egyptian sample, the strongest being between compromising and inter-person type (r=0.394). Among Lebanese, a weak negative statistically significant correlation was found between competing and inter-person type (r=-0.250). Conclusion: The study provides preliminary evidence of a possible influence of culture and ethnicity on the causes and types of conflict, and the resolution strategies used. Further research is needed in this area, preferably comparing more widely different cultures. Clinical relevance: Cultural factors and ethnic differences should be considered in conflict resolution training programs, particularly in multi-ethnic communities.</p> <p>[Samah F. Fakhry QUOTE <b>Fakhry<sup>1</sup></b> and Nevein A. Abou El Hassan. <b>Causes and Types of Conflict and Resolution Strategies among Nursing Students: A Comparative Study between Two Cultures.</b> Journal of American Science 2011;7(4):808-815]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> conflict resolution strategies, nursing students, culture, ethnic</p>	<a href="#">Full Text</a>	111
112	<p><b>Field Survey on Most Common Medicinal and Surgical Diseases in Police Guard and Explosive Dogs from 11/ 2007- 2/ 2010</b></p> <p>Haithem, A. M. , Farghali<sup>1</sup>, Wael, M. Kelany<sup>2</sup>, Mahmoud Ebada<sup>3</sup></p> <p><sup>1</sup> Dept. of Surgery, Anesthesiology and Radiology, Faculty of Vet. Med., Cairo University, Giza, Egypt.  <sup>2</sup> Dept. of Internal Medicine, Faculty of Vet. Med., Cairo University, Giza, Egypt.  <sup>3</sup> Vet. Director of K9 Center, Police officers Insurance Fund, Giza, Egypt.</p>	<a href="#">Full Text</a>	112

	<p style="text-align: center;"><a href="mailto:wael6kelany@yahoo.com">wael6kelany@yahoo.com</a></p> <p><b>Abstract:</b> Medicinal and surgical diseases are most common health problems in police guard and explosive dogs used for protection of organizations of high economic importance and tourism in Egypt. The present study was aimed to calculate the percentage of most common diseases and to evaluate the degree of success for routine management of these problems. The present survey was carried out on 151 dogs resulted in 1229 cases in different body systems from 11/ 2007 to 2/ 2010. These problems arranged according to percentage in descending manner as follow: pruritus (24.8%) which recorded the highest percentage followed by Ticks (16.4%), surgical wounds (9.8%), diarrhea (9.1%), otic pruritus or ear infection (8.5%), vomiting (5.2%), scrotal affections (4.2%), general weakness (3.4%), bone affections (2.6%), respiratory signs (2.4%), ear trauma or ear hematoma (2.12%), fever (2.1%), tail arrada (1.7%), alopecia without itching (1.51%), deaths and euthanasia (1.5%), muscle affections (1.4%), hemorrhage (1.1%), abscesses (0.7%), joint affections (0.5%), eye affections (0.5%), urinary signs (0.2%) and nervous signs (0.08%). Effective nursing plans were designed to minimize and control all these problems. [Haithem, A. M., Farghali, Wael, M. Kelany, Mahmoud Ebada. <b>Field Survey on Most Common Medicinal and Surgical Diseases in Police Guard and Explosive Dogs from 11/ 2007- 2/ 2010</b>. Journal of American Science 2011;7(4):816-826]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> dogs, diseases, gastroenteritis, pruritus, otic, respiratory, lameness, scrotal, wounds, urinary, nervous</p>		
113	<p style="text-align: center;"><b>ii-Preliminary Study in Diagnosis and Early Prediction of Preeclampsia by Using FTIR Spectroscopy Technique</b></p> <p style="text-align: center;">Gehan A. Raouf<sup>1*</sup>, Abdel-Rahman L. Al-Malki<sup>2</sup>, Nesma Mansouri<sup>3</sup>, Rogaia M. Mahmoudi<sup>4</sup></p> <p style="text-align: center;"><sup>1</sup>Medical Biophysics Lab., King Fahd Medical Research Centre; Biochemistry Dep., Faculty of Science, King Abdulaziz University, 21551 Jeddah –KSA B.O.Box:42805</p> <p style="text-align: center;"><sup>2,4</sup>Biochemistry Dep., Faculty of Science, King Abdulaziz University, Jeddah –KSA</p> <p style="text-align: center;"><sup>3</sup>Obstet. Gyneo. Dep., Faculty of Medicine, King Abdulaziz University, Jeddah–KSA <a href="mailto:gehan_raouf@hotmail.com">gehan_raouf@hotmail.com</a></p> <p><b>Abstract:</b> Preeclampsia is a heterogeneous condition, potentially involving several separate pathophysiological pathways; currently no clinical screening test is useful for prediction of preeclampsia development. Fourier-transform infrared spectroscopy (FTIR) holds great promise for clinical chemistry measurements. FTIR spectra of plasma samples from pregnant women -14 patients and 31 normotensive were obtained. Second derivative spectra, Kramer Krong refractive index and ANOVA test were tacking in comparison studies. The parameters studied were proteins and lipids. Different absorbance ratios for specific bands were calculated and plotted versus the patient samples. The absorbance IR spectra of these two groups were slightly different, but from the curve fitting analysis, the protein secondary structure compositions were significant different. The decrease in -helix structure due to oxidative stress in patient group might be responsible of the dramatic increase in - turns and unordered structure. Moreover, the peaks present in the IR second derivative, for patient group, at 1744cm<sup>-1</sup> (cholesterol and triglycerides ester C=O), 1710cm<sup>-1</sup> (carbonyl C-O stretch), and 1621cm<sup>-1</sup> (peptide C=O stretch) positively correlated with low density lipoprotein (LDL) oxidation. The results showed that among the normotensive control group three subjects later developed preeclampsia. Normotensive pregnant women who developed preeclampsia were considered as subjects at high risk. This study suggests, for the first time that FT-IR spectroscopy can be successfully used as an accurate and rapid test, for diagnosis and confirmed with 33% confidence level early prediction of preeclampsia, starting from 20 week of gestation. [Gehan A. Raouf, Abdel-Rahman L. Al-Malki, Nesma Mansouri, Rogaia M. Mahmoudi. <b>ii-Preliminary Study in Diagnosis and Early Prediction of Preeclampsia by Using FTIR Spectroscopy Technique</b>. Journal of American Science 2011;7(4):827-836]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Fourier Transform Infrared Spectroscopy (FTIR); Oxidative Stress; Dyslipidemia; Preeclampsia; Plasma</p> <p><b>Abbreviations:</b> Fourier transform infrared spectroscopy (FTIR)</p>	<a href="#">Full Text</a>	113
114	<b>Gastrointestinal Trichobezoars, How They Present?</b>	<a href="#">Full</a>	114

	<p style="text-align: center;"><b>*Khalid A. Sanousy and Mohammad A. Osman</b></p> <p style="text-align: center;">Pediatric Hospital, Assiut University, Assiut Government, Egypt  <a href="mailto:Khalids@aun.edu.eg">*Khalids@aun.edu.eg</a></p> <p><b>Abstract:</b> We report a case of gastrointestinal trichobezoar in a female patient, aged 7 years who, presented by chronic abdominal pain and diarrhea for a duration of 6 month. She had anorexia and low weight (16 kgm). Many investigations were done including stool analysis, urinalysis, and abdominal ultrasonography without any result. By accurate abdominal examination a very irregular epigastric mass was felt. An abdominal CT was performed that revealed (as reported by the radiologist): "multiple enlarged mesenteric lymph nodes and thickened mesentery which suggests tuberculous enteritis". Tuberculin test was negative. A therapeutic test for T.B. lead to no improvement. Abdominal exploration revealed a mass inside the stomach which was extracted by gastrotomy and proved to be a huge trichobezoar taking the shape of the stomach and extending from the fundus till the first part of the duodenum.  [Khalid A. Sanousy and Mohammad A. <b>Osman Gastrointestinal Trichobezoars, How They Present?</b>. Journal of American Science 2011;7(4):837-839]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Keywords:</b> Bezoar, Trichobezoar,  Phytobezoar, Gastrointestinal bezoar,  Foreign bodies</p>	<a href="#">Text</a>	
115	<p style="text-align: center;"><b>Field Studies on Effect of Probiotic on Reproductivity of 51 Weeks Old Broiler Breeder Chickens Fed on Mycotoxins Contaminated Ration</b></p> <p style="text-align: center;"><b>M.M. Amer <sup>1*</sup>, Kh. M. EL-Bayomi<sup>2</sup> and Zeinab, M. S.Amin. Girh<sup>2</sup>.</b></p> <p style="text-align: center;"><sup>1</sup>. Poultry Dis. Department, Faculty of Vet. Med., Cairo University.  <sup>2</sup>. Poultry dis. department, National Res. Center, Dokki, Giza.  <a href="mailto:Profdramer@yahoo.com">*Profdramer@yahoo.com</a>.</p> <p><b>Abstract:</b> A total of 14100 Ross broiler breeders aged 51 weeks showing signs of mycotoxicosis were used in 9 weeks field study. The chickens were pleased in 2 houses each contain 6600 female + 450 male. Birds of house 1 were treated with Senertox<sup>®</sup> (enzymes, organic acids and yeast extract) 0.5 ml/liter drinking water and house 2 was kept as nontreated. Reproductivity parameters were calculated for comparison of their effect. Treated flocks showed improved average egg production compared with nontreated, but all still lower than farm stander in the 1<sup>st</sup> 3 weeks (51-53) of treatment. Total 9 weeks production declined was 5.6% and 8.4% in Senertox and control flocks respectively . Control flock was slower in decline than treated flocks. Average cumulative egg production/hen in treated flocks were lower than standard and nontreated. The Senertox show high weekly cumulative average egg production and hatched egg/hen (3.92 and 3.80) than nontreated control (3.83 and 3.73). Hatchery parameters of treated were improved in treated at the first 3 weeks post treatment; fertility and hathability rates in Senertox (78.25% and 67.19%) were higher than those of nontreated (76.91% and 62.25); respectively. Culls % in hatched chicks was highest in nontreated flock (2.22%) than Senertox (1.91%). The difference between fertility - hatchability of treatment Senertox chickens was 10.84, while it was 9.72 in control. The drinking water treatment did not restore reproductively of treated flock to farm stander. In conclusion, our field study cleared that administration of antimycotoxins in drinking water as treatments of Ross broiler breeders resulted in a higher reproductive performance as compared with nonmediated control. So we still in need for more effective products to be used against mycotoxins in breeder chicken.  [M.M. Amer, Kh. M. EL-Bayomi and Zeinab, M. S.Amin. Girh. <b>Field Studies on Effect of Probiotic on Reproductivity of 51 Weeks Old Broiler Breeder Chickens Fed on Mycotoxins Contaminated Ration</b>. Journal of American Science 2011;7(4):840-844]. (ISSN: 1545-1003). <a href="http://www.americanscience.org">http://www.americanscience.org</a>.</p> <p><b>Key words:</b> Antimycotoxins, Nutritox, Synertox, Broiler breeder performance, reproductivity, Egg production, Fertility, Hatchability.</p>	<a href="#">Full Text</a>	115
116	<p style="text-align: center;"><b>Pulsed Electromagnetic field versus Microcurrent on Treatment of Mechanical Low Back Pain in Post Menopausal Women</b></p>	<a href="#">Full Text</a>	116

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**Abstract:** Background: Mechanical low back pain is considered as a serious health problem worldwide especially post menopausal period because it certainly can limit function and capacity in both work and personal life. Purpose the study: to investigate and compare the efficacy of pulsed electromagnetic field versus microcurrent in treatment mechanical low back pain in post menopausal women. Methodology: Thirty post menopausal women complain from mechanical low back pain participated in this study. Their age ranged from 50 to 60 years. They were divided randomly into two groups of equal number. Group A received the pulsed electromagnetic field therapy while group B received microcurrent therapy on lower back region. Both groups received the same physical therapy program which includes infrared, stretching exercises and strengthening exercises for back and abdominal muscles for four weeks. Pain severity and lumbar range of motion (flexion, extension, right rotation and left rotation) were measured respectively by serum cortisol level and Back range of motion device (BROM) before and after four successive weeks of treatment. Results: indicated that there was statistically significant improvement in back pain and lumbar range of motion in group "A" compared with those in group "B". Conclusion: Pulsed electromagnetic field proved to be more beneficial than microcurrent in improving lumbar range of motion and perceived back pain in post menopausal women with mechanical low back pain.

[Neveen A. Abdel-Raouf and Soheir Mahmoud Ali El Kosery. **Pulsed Electromagnetic field versus Microcurrent on Treatment of Mechanical Low Back Pain in Post Menopausal Women.** Journal of American Science 2011;7(4):845-853]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Key words:** Pulsed electromagnetic field, Microcurrent, Mechanical Low Back Pain, Post menopausal period

[Full Text](#)

**Detection of hepatitis C virus RNA in the saliva using real-time PCR with emphasis on oral lichen planus**

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**Abstract:** HCV plays an important role not only in liver diseases but also in the establishment of extrahepatic manifestations and immune abnormalities. Oral lichen planus (OLP) that appears in the oral cavity has been reported as an extrahepatic lesion induced by HCV. HCV RNA has been detected in the saliva of HCV positive patients. If sterilization and disinfection techniques are inadequate, there is an increased risk of HCV transmission to exposed individuals. The current study included a group of 40 HCV RNA positive patients. Paired blood and saliva samples were tested by real time PCR for HCV viral. Dental examination was performed for all patients. HCV RNA was found in 17 out of the 40 saliva specimens (42.5 %), obtained from the patients. No statistical significant relation was found between the detection of HCV RNA in the saliva and the different dental treatments as risk factors. There was no correlation between viral load in the serum and viral load in saliva. Also, there was no statistically significant relationship between serum HCV RNA viral load and the detectability of HCV RNA in the saliva. Three patients out of 40 (7.5%) had OLP.

[El-Zarka M. S, El-Nouaem M. I., Metwally D E. and Essawy M. M. **Detection of hepatitis C virus RNA in the saliva using real-time PCR with emphasis on oral lichen planus.** Journal of American Science 2011;7(4):854-859]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Keywords:** HCV; saliva; oral lichen planus; real time PCR

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## Productivity in Private and Public Food Industries of Iran

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**Abstract:** One of Iran's most important industries is food industries that has a large effect on Iranian economy. The number of public food industries has decreased from 246 units in 1995 to 127 units in 2006. On the other hand the number of private food industries has increased from 1636 units in 1995 to 2077 units in 2006. Due to these changes in ownership this paper examined the labor productivity and total productivity in private and public food industries of Iran in 1995-2006 period. The results show that, unlike the normal theory where the private sector is always better, labor productivity and total factor productivity in public sectors of food industries were higher than private sectors industries over the period. The main responses for this inconsistency are due to higher wages, higher capital per worker and lower women employees in public sector against private sectors of food industries.

[Ahmad Afrooz, Khalid B Abdul Rahim. **Productivity in Private and Public Food Industries of Iran**. Journal of American Science 2011;7(4):1-6]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Keywords:** Public Sector, Private Sector Labor Productivity, Total Productivity, Privatization, Food Industry.

### 1. Introduction

Food processing plays an important role in economic development. It can provide new outlets for agricultural output, raising the income of farmers, who tend to be poorer than non-farmers. The sector is sometimes involved in providing credit, seed, and technical assistance to producers in order to obtain higher-value crops. Furthermore, food processing generates employment, more so than many other manufacturing sectors because it is relatively labor-intensive. Since food processing plants are often located in rural areas, they create jobs for rural households, where poverty is often concentrated. Finally, the food processing sector can play a role in improving nutrition through fortification and the supply of foods with longer shelf-life (2002). As a result, this industry is one of the largest industries in Iran. Based on the 2006 reports by the Statistical Centre of Iran (SCI), the sector is ranked first in terms of employment (18 percent). Moreover, in terms of value-added, it is ranked third (16 percent).

In addition, the development of these industries would increase the demand for agricultural products in food processing and reduce the level of waste. The importance equally lies in identifying the strength and the weakness of the food industry in presenting scientific solutions to researchers. It will also assist economic policymakers to reach their program goals quickly. Briefly, the importance of food industries is due to three important factors; 1) Priority of the Non-oil Exports in Foreign Trade, 2) Respond to Nutrition of population, 3) Prevention of Wastage. Over the last two decades the government has encouraged the expansion of agro-industries and food industries. One of the ways that has been chosen

by the government is industries' privatization. The policies emphasized on decreasing the public ownership in industries and encourage more private sectors ownership. According to these policies in recent years the number of public industries has decreased from 1101 in 1995 to 508 in 2006<sup>1</sup> and the number of public food industries has decreased from 246 units in 1995 to 127 units in 2006. Also the number of private food industries has increased from 1636 units in 1995 to 2077 units in 2006 (SCI, 2007/2008). In theory, one of the aims for privatizations is to maximize the profit of firms. The increment of productivity is one of the ways that can increase the firms' profit. Now the question is, what are the differences between public and private food industries of Iran in terms of productivity? In other words, does the privatization lead to high productivity? This paper studied the labor productivity and total productivity in private and public food industries of Iran in 1995-2006 periods.

### 2. Literature review

The economic theory of productivity measurement goes back to the work of Jan Tinbergen (1942) and independently, to Robert Solow (1957). These studies formulated productivity measures in a production function context and linked them to the analysis of economic growth:

$$Y(t) = A(t) \cdot F[K(t), L(t)]$$

Where  $Y(t)$  stands for aggregate production (or aggregate income),  $K(t)$  is the stock of physical capital used in production,  $L(t)$  is the amount of labor inputs and  $A(t)$  is the total factor productivity.

<sup>1</sup> Manufacturing with more 10 workers

International organizations of productivity (APO & OECD)<sup>2</sup> have attempted to present a practical guide for the measurement of productivity. Their attempt has been to compare economies in terms of productivity.

In recent years several attempts have been made to investigate and compare the productivity between private and public sectors of economic. However according to the neoclassic theory, the private sectors are more efficient than public sectors but empirical studies often find that the effect of ownership on firm productivity to be ambiguous. Studies done by Atkinson and Halvorsen (1986), Boardman and Vining (1989), Martin and Parker (1997, chapter 5), Krishnan (2000, 1986) and Yarrow (1986) suggest that there are cases that exist where private ownership does not lead to productivity gains or is even detrimental to productivity. On the other hand studies like Ram (1996), Corneoa and Robb (2003) and Schmitz Jr. and Teixeira (2008) showed that that privatization has increased productivity.

Due to the importance of food industries of Iran, this paper at first investigates the total productivity and labor productivity in private and public sectors of food industries and then analyzes the difference productivity in these two sectors.

### 3. Methodology

The objective of this paper is to investigate and compare the labor and total productivity in public and private food industries of Iran.

In the first stage of productivity measuring is to compute labor productivity in both private and public sectors of food industries based on the index below;

$$LP_V = \frac{V}{L} \quad (1)$$

Where:

$LP_V$  : is labor productivity based on added value.

V: is added value in fixed price<sup>3</sup>

L: is number of workforce

In the second stage, Kendrick's index will be applied to measure the total productivity levels in both private and public sectors (Kendrick, 1984).

#### Total factor productivity and Kendrick Index

The production function expresses an output as a function of the stock capital, employment, and a shift factor (t), time, where the latter proxies the effects of

productivity and technical progress. The subscript t also represents time.

$$Q_t = F(K_t, L_t, t) \quad (2)$$

Assume that the argument "t" is separable from K and L;

$$Q_t = A_t F(K_t, L_t) \quad (3)$$

This way,  $A_t$  is referred to as exogenous, disembodied, and Hicks-neutral technical progress and was measured by how output changes and time elapses with the input bundle held constant. Therefore, the notion of overall productivity can be reinterpreted as an index of all those factors other than labor and capital not explicitly accounted for but contributed to the generation of output.

$$A_t = \frac{Q_t}{F(K_t, L_t)} \quad (4)$$

### 3.1 Kendrick Index

Kendrick's index of total factor productivity for the case of value added as output, and two inputs can be written as:

$$A_t = \frac{V_t}{F(rK_t, wL_t)} \quad (5)$$

Where;

$A_t$  is the value of index in a given year,

$V_t$  is the added value;  $w$  and  $r$  denote the factor rewards of labor and capital respectively in the base year.

### 4. Data sources

Annual data on output, value added, capital and labor for the private and public sectors of food industries were compiled for the periods 1995–2006 from the *Annual Survey of Manufacturing Industries* published by the Statistical Centre of Iran. The variables were deflated by using price index of each group on the base year 1997 that was published by the Central Bank of Iran.

### 5. Empirical results

The levels of labor productivity between private and public sectors of food industries were obtained by using index (1) in the equations below;

$$LP_t^{private} = \frac{V_t^{private}}{L_t^{private}} \quad (6)$$

$$LP_t^{public} = \frac{V_t^{public}}{L_t^{public}} \quad (7)$$

The levels of total productivity between private and public sectors of food industries were obtained by using Kendrick Index in the equations below:

<sup>2</sup> Asian Productivity Organization (APO).

Organization for Economic Co-Operation and Development(OECD)

<sup>3</sup> Added value deflated by using price index related to industries that have been presented by central bank of Iran (CBI).

$$TFP_t^{private} = \frac{V_t^{private}}{INPUT_t^{private}} \quad (8)$$

$$TFP_t^{public} = \frac{V_t^{public}}{INPUT_t^{public}} \quad (9)$$

Where,  $TFP_t^{private}$  and  $TFP_t^{public}$  are total productivity,  $LP_t^{private}$  and  $LP_t^{public}$  are labor productivity,  $V_t^{private}$  and  $V_t^{public}$  are added value in terms of fix price (1997),  $L_t^{private}$  and  $L_t^{public}$  are number of workers and  $INPUT_t^{private}$  and  $INPUT_t^{public}$  are value which used input in the private and public food industry respectively. The levels of labor productivity and total productivity between private food industries and public food industries are summarized in Table (1).

Table (1) Labor and total productivity in private and public food industries

YEAR	TOTAL PRODUCTIVITY		LABOR PRODUCTIVITY	
	PRIVATE	PUBLIC	PRIVATE	PUBLIC
1995	0.493544	0.490416	26.60409	31.86285
1996	0.502194	0.476469	27.86451	33.04318
1997	0.556328	0.451104	34.27209	37.28131
1998	0.509412	0.466037	37.03178	40.95548
1999	0.523245	0.485313	34.69558	42.60307
2000	0.473541	0.466206	33.00469	38.89739
2001	0.46871	0.465687	30.85966	40.30671
2002	0.439507	0.56302	36.59408	52.32396
2003	0.423613	0.419512	34.28353	43.6104
2004	0.353915	0.501445	32.58854	49.69858
2005	0.416714	0.506108	38.12508	55.17463
2006	0.432194	0.505013	43.82133	49.67505

The results of this study indicate that the level of labor productivity in private sector of food industry

have been less than public sector in the overall periods of 1995-2006, see Table (1) and Figures (1).

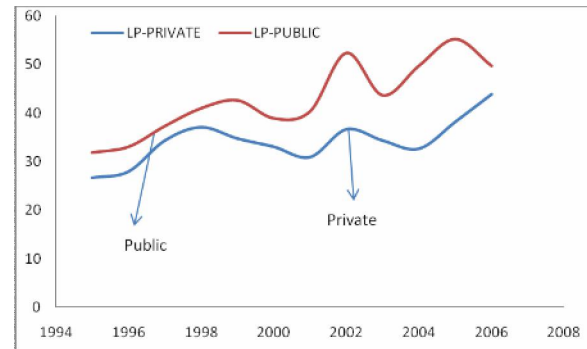


Figure (1) Labor productivity in private and public sectors of food industries

Also the total productivity in the private sector of food industry has been less than public sector at the latest years; see Table (1) and Figure (2).

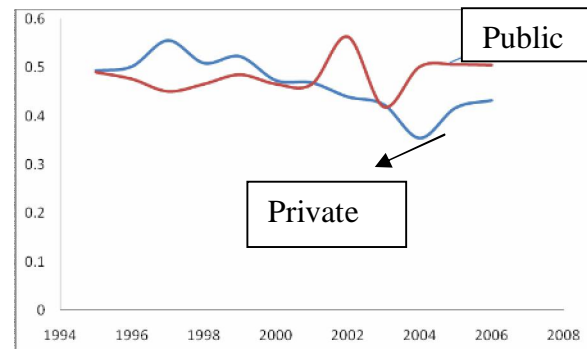


Figure (2) Total productivity in private and public sectors of food industries

This study aimed to research on the reasons for this inconsistency in the privatization in food industries. Several reasons have been found for this problem; one of the findings was that the average wages in public sectors were more than private sectors in food industries, Table (2) and Figure (3) show that it is existent in the target periods. According to empirical evidences related to *efficiency wage models*<sup>4</sup> for example Stiglitz (1986), Levine (1992) and Abbas and Zaman (2005) found that the wages are related to labor productivity. In other words when there is an increase in the workers' wage then it will lead to an

<sup>4</sup> In the efficiency wage model, a firm may be willing to pay its workers a real wage that is higher than the wage that would be competitively determined, because this induces the firms employees to work harder.

increase in their productivity. Therefore this model (efficiency wage model; a worker's effort increases with the wage he or she receives) may be consistent with food industries of Iran that the researchers need to study it.

Table (2) The average real wages in private and public food industries

YEAR	AVRAGE REAL WAGE-FOOD	
	PRIVATE	PUBLIC
1995	6.430424	9.640199
1996	6.794909	10.51704
1997	8.449847	12.56129
1998	9.421533	13.97087
1999	8.311943	13.16719
2000	8.409587	13.78154
2001	9.408525	12.79492
2002	9.715624	15.71631
2003	9.676681	14.40667
2004	10.2673	16.30848
2005	10.98688	15.63313
2006	12.19288	17.26739

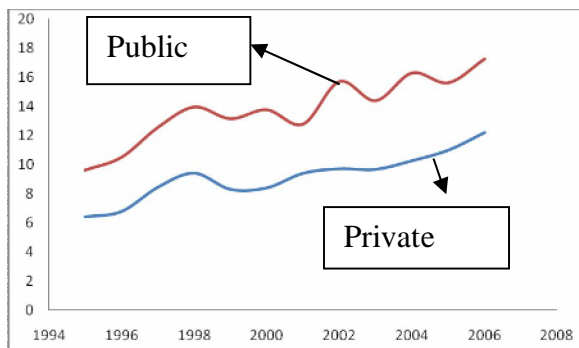


Figure (3) The average real wages in private and public food industries

Another reason for the existence of low productivity in private sector against public sector is low capital per worker in private sector vs public sector. Also the ratio of women to total workers in private sector is more than the ratio of women to total workers in public sector; see Table (3) and Figures (4 & 5). As Table (3) and Figures (4 & 5) show in the earlier period the ratio of capital per worker in private sector was more than public sector but the trend of ratio of capital per worker in private sector went downwards and in the later years it has been less than public

sector. This matter can be the reason for low total productivity in the later years.

Table (3) The ratio of women to total workers and the capital per worker in private and public food industries.

Table (4) The ratio of women to total workers in private and public food industries

YEAR	Ratio of Women to Total Workers		Ratio of Capital Per Worker	
	PRIVATE	PUBLIC	PRIVATE	PUBLIC
1995	0.119861	0.035395	84.22441	113.7704
1996	0.11459	0.035366	71.6858	103.1611
1997	0.104823	0.032807	64.57103	102.8042
1998	0.109117	0.037839	63.10074	96.51353
1999	0.116535	0.045166	50.43221	79.75551
2000	0.119787	0.030641	42.71445	74.62309
2001	0.118715	0.048281	38.86416	69.62781
2002	0.117817	0.022032	31.73403	78.59828
2003	0.13316	0.037139	29.24891	81.7485
2004	0.145418	0.027629	30.70274	97.22351
2005	0.145674	0.029516	31.51425	110.7223
2006	0.151645	0.028544	35.05036	160.9383

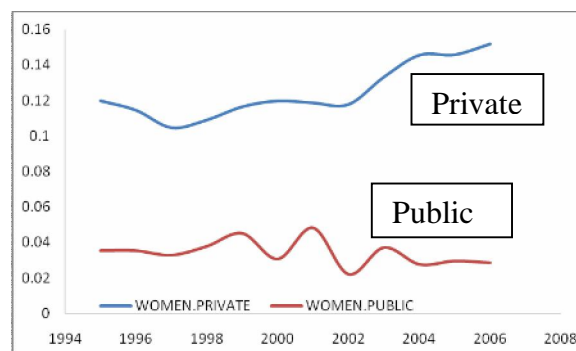
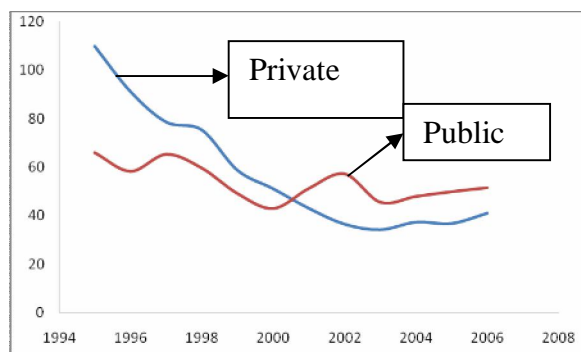


Table (5) The ratio of capital per worker in private and public food industries



Lastly, another reason for having low productivity in private sector of food industries is that the ratio of women workers in private sector was higher than public sector. According to empirical evidences female employees 'productivity are generally less than male employees' (Verner, 2000), (Crepon, Deniau, & Perez-Duarte, 2002), (Kawaguchi, 2003) and (Liqin & Xiao, 2006)

### Conclusion

The government has over the last two decades encouraged the expansion of agro-industries and food industries. One of the ways that has been chosen by the government to expand agro-industries and food-industries is through industries' privatization. The policies emphasized a decrease in public ownership in the industries and encouraged a proliferation of private sectors. According to these policies in recent years the number of public industries has decreased from 1101 in 1995 to 508 in 2006 (sic)<sup>5</sup> and the number of public food industries has decreased from 246 units in 1995 to 127 units in 2006. Also the number of private food industries has increased from 1636 units in 1995 to 2077 units in 2006. Regarding these changes in ownership this paper examined the labor productivity and total productivity in private and public food industries of Iran in 1995-2006 periods. Unlike the classic theory, the results showed that labor productivity and total factor productivity in public sectors of food industries were higher than private sectors of food industries over the target period. The main reasons for this inconsistency have been higher wage, higher capital per worker and low women employees in public sector against private sectors of food industries.

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<sup>5</sup> Manufacturing with more than 10 workers

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## Efficiency of Different Biocontrol Agents on both Susceptible and Resistant Bean Plants and their Protein Pattern Consequences

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**Abstract:** Five *Streptomyces* Spp. namely *St. albadncus*, *St. vastus*, *St. griseoplanus*, *St. murinus* and *St. lydicus* were screened for their efficiency to control *Rhizoctonia solani* root rot pathogen *in vitro*. Results proved that *Streptomyces lydicus* was the most potent biocontrol agents against the fungal pathogen tested. However, the experiment was conducted to a greenhouse to investigate the differences in protein pattern between resistant and susceptible varieties of bean plants in response to biological control to investigate the mechanism of pathogen related protein in pathogenicity. Results *in vivo* showed that the biocotol used obviously reduced the infection percentage up on susceptible bean variety down to 94/22 and for resistant variety to 39/6. Accordingly, the growth parameters also revealed that the response of the susceptible plants were generally more than that of the resistant one. Interestingly, results of protein pattern clarify that the highest protein bands as well as the unique bands were only detected in both susceptible control and resistant infected bean plants treated with the biocontrol agent respectively. Furthermore, the genetic distance (GD) results revealed that the highest GD was detected also between the two mentioned treatments. In addition, the data obtained from the genetic similarity of protein pattern proved that the lowest similarity was also between both the susceptible control and resistant infected bean plants treated with biocontrol agent respectively. Amazingly, the highest genetic similarity of protein pattern was detected between both susceptible infected bean plants treated with biocontrol and resistant control one. Finally, our results suggested that there are a great similarity between the susceptible infected variety treated with biocontrol agent and the resistant control untreated variety but not between the resistant infected variety treated with biocontrol agent and the susceptible control untreated variety. This may also give an impression that the pathogen resistant protein (PR) works independently in the susceptible plants but works dependently in the resistant one.

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**Keywords:** Biological control; *Streptomyces Spp.*; *Phaseolus vulgaris*; Electrophoresis protein pattern

### 1. Introduction

Root rot of common bean (*Phaseolus vulgaris* L.) is a soil-borne disease that is incited by several fungal pathogens including *Fusarium* spp., *Pythium* spp. and *Rhizoctonia solani*. It occurs in all bean-growing areas of the world leading to enormous crop losses. The pathogen is known to be very persistent in soil and capable of surviving in infested fields for very long period and is difficult to control (Burke and Hall, 1991). Disease management options include crop rotation, improving soil fertility levels, use of resistant cultivars, use of fungicides and biological control, but, the impetus for developing biological control agents has been the public perception of pesticide toxicity in the environment (Saman, 2007). Moreover, Mahade Van and Crawford (1997) identified *Streptomyces lydicus* was as abroad spectrum biocontrol agent that proceed to produce an extracellular chitinase enzyme and, one or more antifungal agents. In spite of, changes in amino acid pattern of plants as affected by fungal infection have received adequate attention as reported by Benedict and Hildebrand (1958).

Our knowledge of molecular events occurring during plant pathogen interactions has expanded significantly in the last ten years. Based on this knowledge, several strategies have emerged for developing crop varieties resistant to pathogens. Strategies include the manipulation of resistance by expression of PR proteins. In these cases the observed resistance was not absolute and was restricted to a resistance to limited number of fungi (Grover and Pental, 2003). However, Mauch-Mani and Mettraux, 1998), also mentioned that, activation of disease resistance response in a host plant frequently requires the interaction of a plant gene product with corresponding pathogen derived signal and the products of the resistance genes from diverse plant species show a remarkable structural similarity.

Finally, the objective of this study aims at understanding more about the mechanism of pathogen related proteins (PR), in controlling fungal pathogenicity, and its role played in plant immune system.

## 2. Material and Methods

### Pathogen and biocontrol agents

*Rhizoctonia solani* f. sp. (*Phaseoli*) was isolated from diseased common bean plant root tissues and maintained on Dox agar medium and then identified at the Agriculture Research Center. Also, the identified *Streptomyces* strains; *St. murinus*, *St. griseoplanus*, *St. vastus*, *St. albadncus* and *St. lydicus* used in this study as a biocontrol agent was kindly Provided.

### Plant material

A pure strain of both susceptible variety (Red Mexico) and resistant variety (Prince) of common bean plant (*Phaseolus vulgaris* L.) was kindly provided by the Agriculture Research Center (A.R.C.), Giza, Egypt.

### Antimicrobial activity test

The antimicrobial activities of the five tested *Streptomyces* spp., *St. murinus*, *St. griseoplanus*, *St. vastus*, *St. albadncus* and *St. lydicus* against root rot bean pathogen *Rhizoctonia solani* were assayed using the cup plate assay method described by Kavanagh (1972).

### Plant cultivation and inoculation

According to Fuchs and Sacristan (1996), a six seeds were cultivated in 5 cm in diameter pots containing 2 Kg of natural (non sterilized) sandy clay soil. Two sets of pots were prepared, the first as susceptible and the second as resistant plants were used in triplicates. Accordingly, the following treatments were prepared for each set as follow:

- uninoculated bean plants (control).
- Bean plants inoculated with the biocontrol *Streptomyces lydicus*.
- Bean plants inoculated with the root rot pathogen *Rhizoctonia solani*.
- Bean plants inoculated with both root rot pathogen and the biocontrol agent as mentioned above.

### Phytopathological analysis

Disease symptoms were assessed, 30 days after inoculation and the disease index was evaluated for severity of root rot and foliar symptoms according to Leath *et al.* (1989) by using a scale consisting of five classes, 0 (no symptoms), 1 (slight and few small lesion on the main tap root), 2 (yellowing and moderate lesion cover up the main tap root), 3 (plant wilted and the root system affected) and 4 (plant severely stunted and the root system was completely destroyed)

Disease Index (DI) was calculated using the five grade scale, according to the formula:  

$$DI = (1n_1 + 2n_2 + 3n_3 + 4n_4) 100 / 4Nt.$$

Where  $n_1$  to  $n_4$  is the number of plants in the indicated classes, and,  $Nt$  is the total number of plants tested.

### Determination of chlorophyll content

Chlorophyll content was determined according to the method of Vernon and Seely (1966). The pigment was extracted by grinding 1 g of fresh leaves with a suitable amount of 100 ml of 80% aqueous acetone (v/v). The optical density of the extract was measured using Carl Zeiss Colorimeter at two wave lengths (649 and 665 nm) the pigment content was calculated using the equation of this method and expressed as mg/g fresh weight.

### Electrophoretic analysis of protein by SDS-PAGE

SDS-PAGE was used for detection of genetic variability among resistant and susceptible plants (*Phaseolus vulgaris* L.) for the determination of quantitative and qualitative of the tris and tris/SDS-soluble proteins. This method was done according to Laemmli (1970) as modified by Studier (1973). In this protocol, electrophoresis is in a vertical slab gel between glass plates. The gel consists of two parts, the upper stacking gel (5%) and the lower resolving gel (15%).

### Gel analysis

The gel analysis was applied by AlphaEaseFC™ ver. 4 software. The characters and states have been subjected to the numerical analysis under Multi Variate Statistical Analysis (MVSP) ver. 3.13p software using similarity and dissimilarity assessment percentage method. The method applied is based on cluster analysis by using an UPGMA, dendrogram illustrating the interspecific relationships of studied samples as percent similarity.

Also, genetic distance was calculated between the samples through MVSP ver. 3.13p software.

## 3. Results and Discussion

### The antagonistic activity of different *Streptomyces* spp. tested against the pathogenic fungus *Rhizoctonia solani* in vitro

Results of the antagonistic ability of the five *Streptomyces* species tested against *Rhizoctonia solani* as plant pathogenic fungus by applying the cup plate method. Table (1) revealed that, there are only one *Streptomyces* sp. namely *St. lydicus* exhibited highly antagonistic potency against the pathogenic fungus *Rhizoctonia solani*. Any way the rest *Streptomyces* spp. tested; namely *St. albadncus*, *St. vastus*, *St. griseoplanus* and *St. murinus* exhibited less antagonistic activity against the root rot Pathogen. Fortunately, the obtained results are parallel to that

obtained by many authors as, Ibrahim *et al.* (2001) and Rasmy (2002), as they proved that most species of the biocontrol agent are able to antagonize many plant pathogenic fungi and sometimes give an equal control effects to those obtained by certain fungicides.

Table 1. The antagonistic activity of different *Streptomyces* spp. tested against the pathogenic fungus *Rhizoctonia solani* in vitro

Types of <i>Streptomyces</i> tested	Mean values of inhibition zones / mm
1. <i>Streptomyces murinus</i>	20
2. <i>Streptomyces griseoplanus</i>	23
3. <i>Streptomyces vastus</i>	25
4. <i>Streptomyces albadncus</i>	26
5. <i>Streptomyces lydicus</i>	27

#### A greenhouse biological control of *Rhizoctonia solani* root rot disease on *Phaseolus vulgaris* susceptible and resistant plants by *Streptomyces lydicus*

Nearly all fields and vegetable crops are suffering from at least one or more fungal plant pathogens and considerable yield losses were recorded which sometimes exceeds 70% (Watkins, 1981 and Morris *et al.*, 1984). Also, microscopic studies of the infection process to different plant hosts by fungal pathogenic isolate of *Rhizoctonia solani* have been well documented by Stockwell and Hanchey (1983).

Any way, the results obtained from table (2) revealed that, the plant pathogenic fungus *Rhizoctonia solani* exerts a drastic effect on the roots of both susceptible and resistant bean plant variety. However, the disease development in susceptible variety was more deleterious than in resistant one. The results obtained are in consistent with that of Burke and Miller (1983) as they proved that root rot pathogen can almost destroy a bean crop, even at highest level of resistance to the disease.

Results also showed that, the use of *Streptomyces lydicus* as a biocontrol agent was able to minimize the drastic action of the pathogenic fungus *Rhizoctonia solani* upon both the susceptible and resistant bean plant varieties by reducing the infection percentage from (94 & 39%) down to only (22 & 6%) for both susceptible and resistant bean plant variety respectively. Interestingly, these results are in agree with that of Mahadevan and Crawford (1997) as they found that, *Streptomyces lydicus* was identified as abroad spectrum as a biocontrol agent that proceed to produce an extracellular chitinase

enzyme, beside one or more of antifungal agents. Any way, all of the other treatments displayed different degree of control values, but generally, the susceptible variety show a less control values than that of resistant one.

#### Gross growth parameters of both susceptible and resistant *Phaseolus vulgaris* plants, biologically controlled by *Streptomyces lydicus* against *Rhizoctonia solani* root rot disease

Results obtained from table (3) revealed that, there are a decrease in all plant growth parameters tested as root length, root fresh weight and total chlorophyll content in both susceptible and resistant *Phaseolus vulgaris* plant varieties in response to *Rhizoctonia solani* fungal infection as compared to their controls. However, the inhibitory effects of the pathogen on plant growth parameters was investigated by many authors (Hamad *et al.*, 2001). In contrast, the use of a biocontrol agent, *Streptomyces lydicus* with resistant one. Interestingly, these results also run parallel to that obtained by both Rodriguez and Cotes in 1999 as they proved that plant treatment by biocontrol agent can significantly activate all of the plant physiological activities. Amazingly, the results obtained, collectively showed that the response percentage of the susceptible variety to all of the biological control treatments measured was higher than that of resistant variety.

#### Protein bands pattern in the electrophoregram of the eight treatment sample tested

Many biochemical studies have been carried out to investigate the metabolic changes associated with the occurrence of plant defence reactions (Dolores *et al.*, 1998 and Hamad *et al.*, 2001). However, our qualitative analysis of the protein pattern was determined on the base of the number, density, molecular weight and reproducibility on SDS-PAGE. Bands with the same mobility were treated as identical fragments. But weak bands with negligible density and smear bands were both excluded from final analysis. However, the electropherogram of the eight treatment samples exhibited the presence of 25 protein bands with molecular weight ranged between 13-158 KDa. On the other hand, the protein bands of the eight treatment samples were varied in number and density of bands whereas S1, S2, S3, S4, S5, S6, S7 and S8 were revealed 18, 13, 16, 12, 14, 13, 13 and 16 protein bands respectively. The variability analysis of the eight samples showed some polypeptides bands absent or/and present in some habitat (polymorphic band; 93, 89, 67, 56, 54, 42, 37, 32, 30, 28, 27, 22, 19, 17 and 16) with percentage of 60%.

Table 2. A greenhouse biological control of *Rhizoctonia solani* root rot disease on *Phaseolus vulgaris* susceptible and resistant plants by *Streptomyces lydicus*

Treatments	Class					Disease index	Infection %
	0	1	2	3	4		
S1: Untreated susceptible plant/control (S.C)	15	2	1	0	0	6	17
S2: (S.C) + Biocontrol <i>St. lydicus</i>	16	2	0	0	0	3	11
S3: Infected plants with <i>Rhizoctonia solani</i> (I.S.P)	1	0	2	6	9	81	94
S4: (I.S.P) + Biocontrol <i>St. lydicus</i>	14	3	1	0	0	7	22
S5: Untreated resistant plant/control (R.C)	17	1	0	0	0	1	6
S6: (R.C) + Biocontrol <i>St. lydicus</i>	18	0	0	0	0	0	0
S7: Infected resistant plants with <i>Rhizoctonia solani</i> (I.R.P)	11	4	2	1	0	15	39
S8: (I.R.P) + Biocontrol <i>St. lydicus</i>	17	1	0	0	0	1	6

Table 3. Gross growth parameters of both susceptible and resistant *Phaseolus vulgaris* plants, biologically controlled by *Streptomyces lydicus* against *Rhizoctonia solani* fungal pathogen

Treatments	Root length / cm	Root fresh weight /gm	Total chlorophyll A+B (mg/g fresh weight)
S1: Untreated susceptible plant/control (S.C)	6.2	10.1	23.3
S2: (S.C) + Biocontrol <i>St. lydicus</i>	6.6	10.5	26.1
S3: Infected plants with <i>Rhizoctonia solani</i> (I.S.P)	3.7	6.8	11.4
S4: (I.S.P) + Biocontrol <i>St. lydicus</i>	7.0	11.6	20.0
S5: Untreated resistant plant/control (R.C)	5.8	9.7	25.1
S6: (R.C) + Biocontrol <i>St. lydicus</i>	7.2	11	27.0
S7: Infected resistant plants with <i>Rhizoctonia solani</i> (I.R.P)	5.5	9.2	18.5
S8: (I.R.P) + Biocontrol <i>St. lydicus</i>	5.6	10	23

Results obtained from both table (4) and Fig. (1 & 2) revealed that, the eight treatments samples characterized by the presence of 6 monomorphic common polypeptide bands with MW of 80, 60, 47, 23, 14 and 13 KDa with percentage of 24%. However, four unique bands were recorded with percentage of 16%, three of them were detected in S1 with MW of 158, 108 and 99 KDa. And the fourth band was detected in S8 with MW of 18 KDa. Interestingly, the obtained results are in agree with the view other authors as the new protein band found in S8 (the resistant infected variety treated with the biocontrol), may be related to the metabolic changes associated with the defence response, and from the metabolic point of view the infected plant cell can produce certain types of proteins called pathogen related protein (PR), that may play an important role in plant defence mechanism, and most of them show antifungal activity (Brigitte and Metraux, 1998).

#### The genetic distance between different treatment samples detected by qualitative analysis of the protein pattern of the eight samples tested

Genetic distance (GD), was measured as the distance difference between each sample. Since, the highest GD was detected between S8 and S1 samples

which represent 0.37. On the other hand, the lowest distance was 0.20 between S5 and S4 as well as between S7 and S6 samples. These results exemplified in table (5) show that, there's a great variation between these samples in genetic content. However, according to the obtained results we can arrange the relations between the susceptible variety treatment sample according to the control in a descended distance as ,(S1 to S2 /0.36, S4 /0.31, and to S3 /0.28) as well as, the resistant variety treatment samples in a descended distance also display (S5 to S8 /0.28, S7 /0.26 and to S6 /0.22).

#### The Genetic similarity between different samples detected by qualitative analysis of the protein pattern of the eight treatment samples

Data obtained from figure (3) & table (6), clarified that the genetic similarity of the eight samples detected by qualitative analysis of the protein pattern similarity ranged between 58.1% and 84.7%. However, the obtained results are in consistent with Mauch-Mani and Metraux (1998) as they mentioned that, the activation of the disease resistance response in a host plant frequently requires the interaction of a plant gene product, with a corresponding pathogen derived signal and the



products of the resistance genes from diverse plant species, show remarkable structural similarity. However, from the qualitative analysis of protein pattern of the eight samples, we can arrange relations between the susceptible variety treatment samples

according to the control in a descended protein pattern similarity as (S1 to S3 /76.5, S4 /66.7 and to S2 /58.1) as well as the resistant variety treatment descended protein pattern similarity also display (S5 to S6 /81.5, S7 /74.1 and to S8 /73.3).

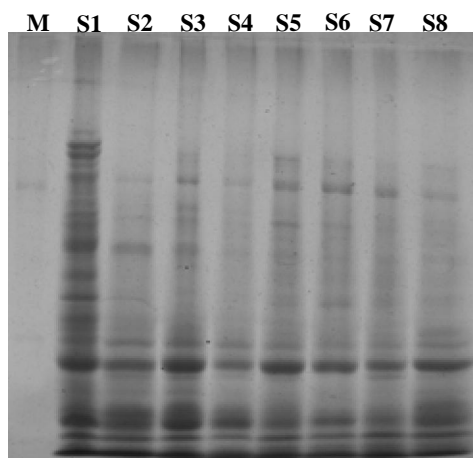


Figure 1. SDS-PAGE protein patterns of eight samples. Lane M: Protein marker, Lanes S1 to S8

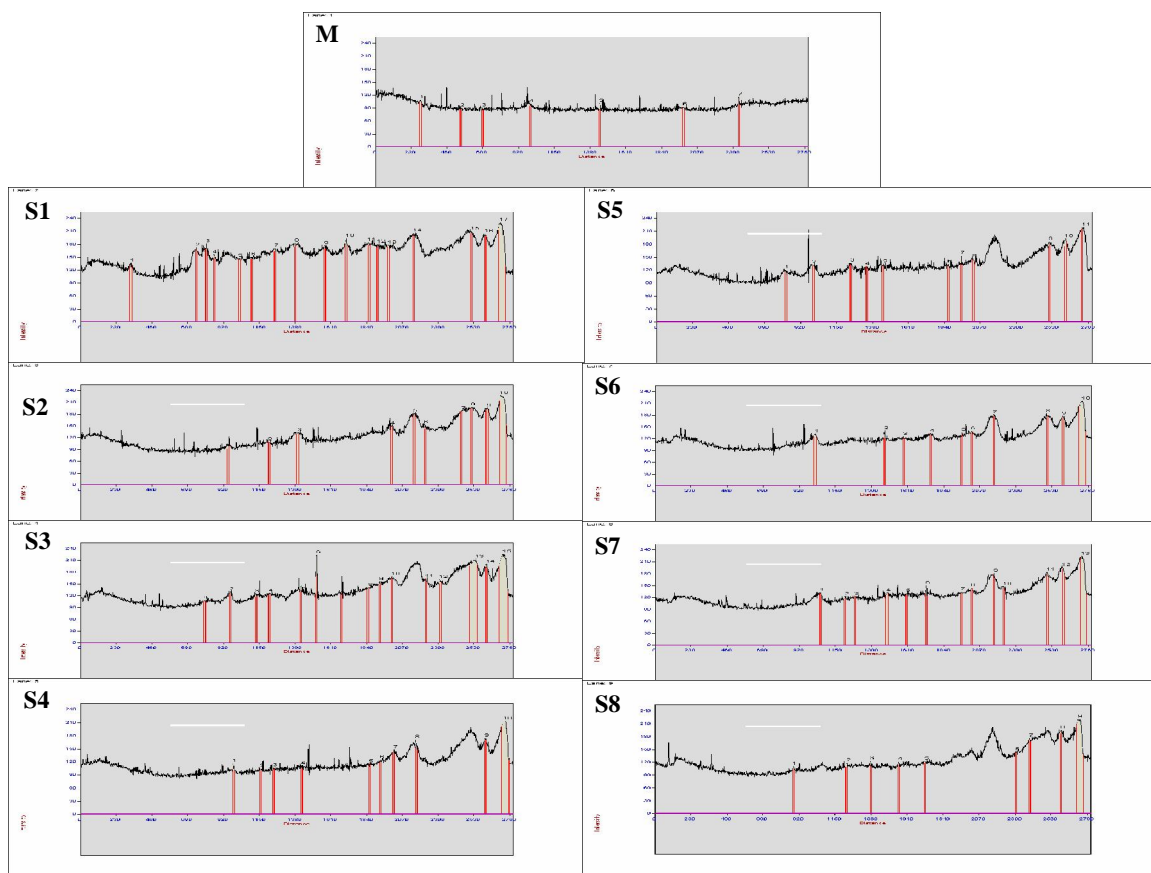


Figure 2. Protein bands pattern in the electrophoregram of (M: marker + eight treatment samples from S1 to S8)

Table 4. Scoring sheet of protein bands pattern in the electrophoregram of the eight treatment samples

Band No.	M.Wt (KDa)	(S1) Lan.2		(S2) Lan.3		(S3) Lan.4		(S4) Lan.5		(S5) Lan.6		(S6) Lan.7		(S7) Lan.8		(S8) Lan.9		polymorphism
		Band score	Relative protein content	Band score	Relative protein content	Band score	Relative protein content	Band score	Relative protein content	Band score	Relative protein content	Band score	Relative protein content	Band score	Relative protein content	Band score	Relative protein content	
1	158	1	2.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	Unique
2	108	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	Unique
3	99	1	7.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	Unique
4	93	1	5.4	0	0.0	1	1.7	0	0.0	1	7.2	0	0.0	0	0.0	0	0.0	Polymorphic
5	89	1	1.6	0	0.0	0	0.0	0	0.0	0	0.0	1	0.9	0	0.0	1	2.7	Polymorphic
6	80	1	0.8	1	1.2	1	3.7	1	2.6	1	10.6	1	7.8	1	5.1	1	2.2	Monomorphic
7	67	1	1.0	0	0.0	1	0.8	1	1.5	0	0.0	0	0.0	0	0.0	0	0.0	Polymorphic
8	60	1	1.8	1	0.9	1	0.9	1	1.2	1	5.6	1	1.2	1	1.9	1	1.6	Monomorphic
9	56	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.2	1	1.5	1	0.9	Polymorphic
10	54	0	0.0	0	0.0	0	0.0	1	0.5	1	0.8	0	0.0	0	0.0	1	1.2	Polymorphic
11	47	1	4.7	1	7.5	1	1.3	1	1.3	1	1.8	1	2.1	1	4.3	1	1.6	Monomorphic
12	42	1	2.4	1	2.5	1	11.7	0	0.0	1	1.5	1	0.7	0	0.0	1	1.2	Polymorphic
13	37	1	5.4	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0	Polymorphic
14	32	1	2.6	1	6.8	1	1.8	0	0.0	1	1.8	1	2.5	1	4.0	1	2.0	Polymorphic
15	30	1	0.9	0	0.0	0	0.0	1	0.5	1	1.8	0	0.0	0	0.0	0	0.0	Polymorphic
16	28	1	1.6	0	0.0	1	1.6	1	1.1	1	2.6	1	1.4	1	0.8	1	2.2	Polymorphic
17	27	0	0.0	1	4.6	1	2.2	1	4.9	1	4.6	1	1.7	1	2.2	1	2.8	Polymorphic
18	23	1	6.1	1	9.9	1	4.4	1	9.6	1	13	1	8.8	1	6.5	1	10.3	Monomorphic
19	22	0	0.0	1	1.5	1	0.6	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	Polymorphic
20	19	0	0.0	1	0.5	1	0.1	0	0.0	0	0.0	0	0.0	0	0.0	1	0.7	Polymorphic
21	18	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	5.6	Unique
22	17	0	0.0	1	5.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	5.0	Polymorphic
23	16	1	3.8	1	4.0	1	19.4	1	8.4	1	10.9	1	8.0	1	10.1	0	0.0	Polymorphic
24	14	1	0.8	1	3.9	1	1.0	1	1.1	1	9.9	1	4.7	1	7.0	1	3.2	Monomorphic
25	13	1	51.0	1	51.4	1	48.7	1	67.3	1	27.9	1	59.0	1	55.2	1	56.8	Monomorphic
Total band score		18	100	13	100	16	100	12	100	14	100	13	100	13	100	16	100	

Table 5. The genetic distance between different treatment samples detected by qualitative analysis of the protein pattern of the eight samples tested

Samples	S1	S2	S3	S4	S5	S6	S7	S8
S1	0.000							
S2	0.3606	0.000						
S3	0.2828	0.2236	0.000					
S4	0.3162	0.3000	0.2828	0.000				
S5	0.2828	0.2646	0.2449	0.2000	0.000			
S6	0.3000	0.2449	0.2646	0.2646	0.2236	0.000		
S7	0.3317	0.2449	0.2236	0.2646	0.2646	0.2000	0.000	
S8	0.3742	0.2646	0.3162	0.3162	0.2828	0.2236	0.3000	0.000

Table 6. Genetic similarity between different treatment samples detected by qualitative analysis of the protein pattern of the eight samples tested

Samples	S1	S2	S3	S4	S5	S6	S7	S8
S1	100.0							
S2	58.1	100.0						
S3	76.5	82.8	100.0					
S4	66.7	64.0	71.5	100.0				
S5	75.0	74.1	80.0	84.7	100.0			
S6	71.0	76.9	75.9	72.0	81.5	100.0		
S7	64.6	76.9	82.8	72.0	74.1	84.7	100.0	
S8	58.8	75.9	68.8	64.3	73.3	82.8	69.0	100.0

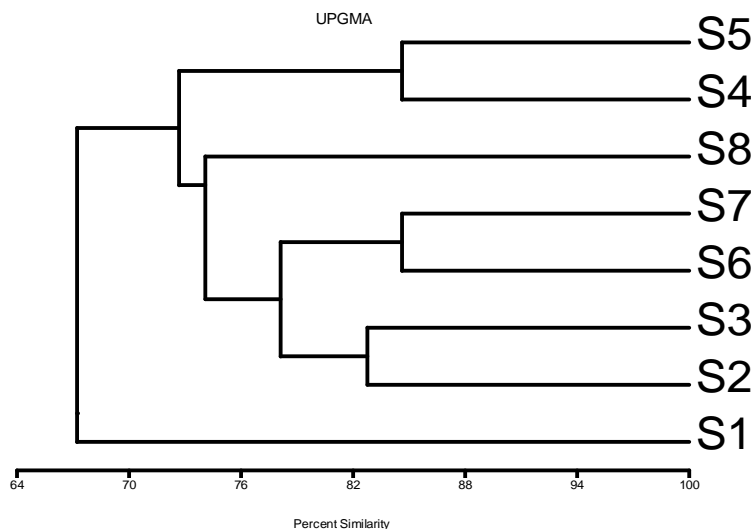


Figure 3. Dendrogram obtained by cluster analysis based on presence/absence of matrix protein

Collectively, and from data obtained in figure (3) and tables (5 & 6) related to both genetic distance and similarity, results conclude that, the higher genetic distance samples is the lower genetic formula affinity and vice versa, so the highest genetic formula affinity was detected between both S4 & S5, and the lowest genetic formula affinity was detected between both S1 & S8, and this in return means that there are a great genetic similarity between the susceptible infected variety treated with biocontrol agent and the resistant control untreated variety S4 & S5, but not between the resistant infected variety treated with biocontrol agent and the susceptible control untreated variety S1 & S8,. More obviously, results conclude that the control of the protein synthesis is therefore a key problem in the resistance mechanism in plants and the proper control of susceptible variety will be equal to that of resistant one, and this may be the ultimate goal for saving a time, effort, and money to produce a new resistant variety annually. Finally, this study highlight on the need for extra work in this field for understanding more about the mechanism of pathogen related proteins (PR) in the resistance and in turn in the plant immune system that may eliminate the plant disease ghost from our life.

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**Technological and biological effects of sodium meta-bisulfite and ascorbic acid on solar dried sheeted tomato**Gamil F. Bareh<sup>1</sup>, A. A. Shouk<sup>1</sup> and Salwa M Kassem<sup>2</sup><sup>1</sup> Food Technology Department, National Research Centre, Dokki, Cairo, Egypt<sup>2</sup> Cell Biology Department, National Research Centre, Dokki, Cairo, Egypt[ekrams@hotmail.com](mailto:ekrams@hotmail.com)

**Abstract:** Sodium meta-bisulphite (SMBS) and ascorbic acid (AA) were added during the processing of solar dried sheeted tomato. SMBS and AA were added to concentrated juice before drying in concentrations 0.67, 0.167 and 0.335 g/L for SMBS while it was 0.110, 0.220 and 0.330g/L for AA. Colour attributes, sensory evaluation and biological evaluation were studied. The obtained results showed that both SMBS and AA improved the final product quality regarding colour and general appearance. The biological studies revealed that SMBS induced chromosomal aberrations in bone marrow and spermatocytes cells especially the concentrations of 0.335g/L. Also, ascorbic acid (0.330 g/L) induced chromosomal aberrations in bone marrow and spermatocytes more than control sample. The effect of SMBS was higher than that of ascorbic acid. Finally, it could be concluded that SMBS had adverse and undesirable effect regardless of its technological advantages.

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**Key words:** tomato, sheets bone marrow, aberrations, sodium meta-bisulphite, ascorbic acid.

**1. Introduction**

Sodium meta-bisulphite is an organic compound. The compound has many chemical properties that make it useful for a variety of industrial purposes. However, there are many dangers of working with or investigating this compound, which make some of its uses especially that of food preservative a topic of research and controversy. Sodium meta-bisulphite is a crystalline powder. It is soluble in water. It releases sulphur dioxide gas when dissolved in water. Sodium meta-bisulfite is used as food preservative and it is usually noted as E223 (Food additives). Sodium meta-bisulphite acts as an antimicrobial and antifungal. It is a reducer. It is commonly found in fruit juices, vinegars, pickles and dried fruits.

According to Latapi and Barrett (2006), two pre-drying treatments, i.e. 1) salt and 2) sodium meta-bisulfite dips were evaluated on sun-dried tomatoes by assessing moisture content, colour, rehydration ratio, mould and yeast count, sulphur dioxide content, an/or salt content. There were significant differences in rehydration ratio, yeast count, and salt in the salt dipping pre-treatment. The most effective conditions from the salt dipping pre-treatment was using a concentration of either 10% or 15% salt for 5 minutes. There were significant differences in rehydration ratio,

yeast count, colour and sulphur dioxide in the sodium meta-bisulfite dipping pre-treatment. Dipping tomatoes in either 6 or 8% sodium meta-bisulfite for 5 minutes resulted the best red colour. Pre-drying treatments have been found to improve the quality of stored sun-dried tomatoes. Specific pre-treatments were chosen for effects on nutritional value, sensory quality, and safety before and after 3 months of storage (25 °C and 30% to 34% relative humidity). These pre-treatments included (1) direct gas sulphuring with 2.3 kg (5 lb) SO<sub>2</sub>; (2) with 3.6 kg (8 lb) SO<sub>2</sub>; (3) dipping in 10% salt for 5 min; (4) 8% sodium meta-bisulfite for 5 min; and (5) 8% sodium meta-bisulfite and 10% salt for 5 min. The use of SO<sub>2</sub> improved colour, rehydration ratio, and minimized the loss of ascorbic acid and lycopene. Sodium meta-bisulfite dipped tomatoes had better rehydration ratio and colour than gas sulphured sun-dried tomatoes. Untrained consumers ranked gas sulphured tomatoes higher than sun-dried tomatoes produced by dipping in either sodium meta-bisulfite alone or sodium meta-bisulfite plus salt.

Sulphites are extensively used in the food and drinks industry. Their toxicity has been previously evaluated by addition to the diet or drinking water of laboratory animals. Because interactions between sulphites and food constituents occur (Ribera, *et al.*,



2001). The results revealed that, these anionic sulphur compounds interact with DNA possibly by changing the topology of this macromolecule. Effects may be due to interactions of these sulphur compounds at higher concentrations with DNA, with resulting ligand-DNA super-coiling. This process could protect against HD intoxication, which is caused in part by the uncoiling of DNA (Baskin, et al., 2000).

On the other hand, (Kayraldiz and Topaktas. 2007) investigated the genotoxic effect of sodium meta-bisulphite (SMB), which is used as an antimicrobial substance in foods on bone marrow cells of rats and found that intra-peritoneal implement of SMB generally more effective increasing the percentage of abnormal cells and CA/cell in all concentrations and treatment period. In addition, mitotic index (MI) data of intra-peritoneal injection are lower than gavages. It can be concluded that potential genotoxic effects of SMB by IP injection is higher than GV injection. The ability of sodium meta-bisulfite which is used as an antimicrobial substance in food, to induce chromosome aberrations (CA) and sister chromatid exchanges (SCE) in human lymphocytes was investigated by Rencüzogullari et al., (2001). SMBS-induced CAs and SCEs at all concentrations (75, 150 and 300 micro-g/ml) and treatment periods (24 and 48h) dose-dependently. However, SMBS decreased the replication index (RI) and the mitotic index (MI) at the concentrations of 150 and 300 micro-g /ml for 24 and 48h treatment periods. This decrease was dose-dependent as well.

The chemical properties of ascorbic acid provide a wide range of industrial applications. The use of ascorbic acid or vitamin (C) depend on its chemical properties as an antioxidant or on its health-related properties. About one-third of total production is used for vitamin preparations in the pharmaceutical industries ((vitamin C). the rest is mainly applied as an additive to food (E300) and feed to enhance product quality and stability. Ascorbic acid technological functions include antioxidant in aqueous systems, retardation of oxidative rancidity and protection from enzymatic browning in processed fruits and vegetables.

Vitamin C is a wide spectrum antioxidant essential for humans, which are unable to synthesize the vitamin and must obtain it from dietary sources. There are two biologically important forms of vitamin C, the reduced form, ascorbic acid, and the oxidized form, dehydro-ascorbic acid. Vitamin C exerts most of its intra-cellular biological functions and is acquired by cells with the participation of specific membrane

transporters. This is a central issue because even in those species capable of synthesizing vitamin C, synthesis is restricted to the liver and pancreas from which is distributed to the organism. Most cells express two different transporter systems for vitamin C; a transporter system with absolute specificity for ascorbic acid and a second system that shows absolute specificity for dehydro-ascorbic acid. In humans, the maintenance of a low daily requirement of vitamin C is attained through an efficient system for the recycling of the vitamin involving the two families of vitamin C transporters, Rivas et al. (2008).

Hesta et al. (2009) investigated the ability of vitamin C to increase the anti-oxidative and immunomodulating potential in healthy dogs. They found that, there was no clear evidence for an effect of dietary vitamin C on antioxidative capacity in healthy dogs fed a diet with vitamin E concentrations well above the recommendations. Yet, a limited number of immunological parameters were slightly affected.

Some biochemical functions of vitamin C make it an essential component of parenteral nutrition (PN) and an important therapeutic supplement in other acute conditions. Ascorbic acid is a strong aqueous antioxidant and is a cofactor for several enzymes. The average body pool of vitamin C is 1.5 g, of which 3%-4% (40-60 mg) is used daily. Steady state is maintained with 60 mg/d in non-smokers and 140 mg/d in smokers, Berger (2009). Vitamin C is a powerful antioxidant and its levels are decreased in Alzheimer's patients. Even sub-clinical vitamin C deficiency could impact disease development. The results indicated an interaction between the cholinergic system and vitamin C that could be important given the cholinergic degeneration associated with Alzheimer's disease, Harrison et al., (2009).

This study was carried out to investigate the technological and biological effects of adding SMBS and AA during the processing of solar dried tomato sheets especially colour quality and sensory evaluation as well as bone marrow and spermatocytes aberrations.

## 2. Material and methods

### 2.1.Materials:

2.1.1.Tomato fruits (*Lycopersicon esculentum*) used for the present study were obtained from local market, Cairo, Egypt.

2.1.2.Sodium metabisulphite and ascorbic acid were obtained from Merck Company, Germany.

### 2.2. Methods

### 2.2.1. Experimental design

The fresh fruits were washed with spray washer. Hot break tomato juice was concentrated under vacuum at 60 °C till the total soluble solids were 12-13% (pureé). Sodium meta-bisulphite in concentrations (0.67, 0.167 and 0.335 g/L) and ascorbic acid in concentrations (0.110, 0.220 and 330 g/L) were added before drying process, as well as, control sample was produced for comparison.

#### \*Drying process

Dried tomato sheets were prepared from tomato puree (12-13% T.S.S.) by spreading on stainless trays and left under solar energy drier designed and equipped with thermostat for temperature control, National Research Centre, Egypt.

### 2.2.2. Sensory evaluation

The acceptability were carried out according to Gould (1974). 14 judge gave degrees to odour, taste acceptability and colour.

### 2.2.3. Color Attributes

The colour of tomato sheets samples was measured using a spectro-colorimeter with the CIE colour scale (Hunter, Lab scan XE). This instrument was standardized against the white tile of Hunter Lab colour standard (LX No.16379): X= 77.26, Y= 81.94 and Z= 88.14. The L, a and b values were reported. Total colour difference (E) was calculated as:

$$[(L)^2 + (a)^2 + (b)^2]^{1/2}$$

### 2.2.4. Biological studies

Male Swiss mice aged 8-10 weeks and weighting 25-30 grams, obtained from a closed random-bred colony at National Research Centre, Cairo, Egypt were used. Food and water were provided libitum.

Tomato sheets containing sodium meta-bisulfite (0.067, 0.167 and 0.335 g/L) and tomato sheets containing vitamin C (0.110, 0.220 and 0.330 g/L) suspended in distilled water, were ingested orally by a dose level 2.5mg/kg body weight. The animals were divided into 7 groups (each of 5mice). The first group was kept as a control and the other 3 groups were orally ingested tomato sheets containing sodium meta-bisulfite with concentration 3 groups and 3 groups were orally ingested tomato sheets containing vitamin C with 3 concentration. The animals were killed by decapitation at the end of experimental period 30days. The animals were injected intra-peritoneal with

Colchicine (0.05%). They were sacrificed 2hr. later to prepare the chromosome of bone marrow and spermatocyte cells according to Yosida and Amamo (1975). Slides were prepared and 50 well-spread metaphases were examined for each animal at each concentration for chromosomal aberrations in bone marrow or spermatocyte cells. The results of chromosomal aberrations were analyzed using analysis of variance (ANOVA).

## 3. Results and discussion

### 3.1. Color attributes of tomato sheets

Data presented in Table (1) show the effect of SMBS and AA treatments on colour characteristics of tomato sheets. As shown in the table, (b values) increased as a result of sing SMBS in all tested levels. That effect because SMBS inhibit the oxidative enzymes resulting red colour and improved tomato sheets quality regarding colour characteristics. Slight darkness (a value) was observed as a result of using SMBS and dehydration process. Regarding a values the treatment of tomato sheets by SMBS slightly affected tomato sheets resulting yellow colour. SMBS is known as anti-browning agent because its inhibitory effect of oxidative enzymes which negatively affected of some food colours. The same trend was also observed regarding ascorbic treatment. AA acid known as antioxidant agent. The effect of SMBS was more effective than AA. The effect was the same on upper of tomato sheets.

Such findings were observed by Latapi and Barrett (2006) as he reported that, the use of SO<sub>2</sub> improved colour, rehydration ratio, and minimized the loss of ascorbic acid and lycopene. Sodium meta-bisulfite dipped tomatoes had better rehydration ratio and colour than gas sulphured sun-dried tomatoes. Untrained consumers ranked gas sulphured tomatoes higher than sun-dried tomatoes produced by dipping in either sodium meta-bisulfite alone or sodium meta-bisulfite plus salt.

### 3.2. Sensory evaluation of tomato sheets

Data presented in Table (2) showed that the effect of addition of sodium meta-bisulphite and ascorbic acid on the sensory evaluation of dried tomato sheet. As shown in the table there was no significant differences between control and treated samples regarding taste, odour and general appearance. But there was significant effect regarding to colour. Both SMBS and AA do as antioxidant and anti-browning agents. They inhibited enzyme activities resulting

desirable colour. The deterioration of colour may be because the oxidation process occurring during dehydration while the presence of SMBS and AA minimized the oxidation process resulting desirable colour. Latapi and Barrett (2006) reported that pre-drying treatments have been found to improve the quality of stored sun-dried tomatoes. Specific pre-treatments were chosen for effects on nutritional value, sensory quality, and safety before and after 3 months of storage (25 °C and 30% to 34% relative humidity). These pre-treatments included (1) direct gas sulphuring with 2.3 kg (5 lb) SO<sub>2</sub>; (2) with 3.6 kg (8 lb) SO<sub>2</sub>; (3) dipping in 10% salt for 5 min; (4) 8% sodium meta-bisulphite for 5 min; and (5) 8% sodium meta-bisulfite and 10% salt for 5 min.

**Table 1: Effect of treatment on colour attributes**

Treatment	Surface			Back		
	L 92.43	a 0.84	b 0.16	L 92.43	a -0.84	b -0.16
Control	25.26	4.51	3.46	26.11	9.34	8.14
SMBS (0.067g/l)	25.86	7.74	4.63	27.97	12.13	11.66
SMBS (0.167g/l)	27.87	4.63	3.47	25.61	8.13	7.71
SMBS (0.335g/l)	26.07	8.05	4.93	28.64	14.17	13.55
AA (0.110g/l)	26.24	7.40	4.84	27.36	12.94	10.78
AA (0.220g/l)	25.25	8.45	4.91	29.23	14.23	13.25
AA (0.330g/l)	25.32	6.30	4.53	25.14	7.51	6.90

SMBS = sodium metabisulphite; AA = ascorbic acid

**Table 2: Statistical parameters of sensory evaluation of treated sheets**

Treatment	Color (10)	Taste (10)	Odor (10)	General appearance (10)
Control	8.27	8.18	8.36	8.26
SMBS (0.067g/l)	8.26	7.90	8.18	8.18
SMBS (0.167g/l)	8.27	7.54	8.00	7.90
SMBS (0.335g/l)	8.09	7.81	7.54	7.81
AA (0.110g/l)	8.18	7.90	7.72	8.09
AA (0.220g/l)	8.00	7.63	7.18	8.18
AA (0.330g/l)	8.81	8.36	8.27	8.63
LSD	N.S	N.S	N.S	N.S

SMBS = sodium metabisulphite; AA = ascorbic acid

### 3.3. Biological studies

The results of the cytological examination of bone marrow and spermatocytes cells of mice, ingested orally with tomato sheets containing sodium meta-bisulfite (2.5mg/kg b.w) and tomato sheets containing vitamin C were listed in tables (3 and 4). The structural aberrations induced in both types of cells were highly significant ( $p < 0.05$ ) in the case of the tomato sheets containing sodium meta-bisulfite and tomato sheets containing vitamin C. they were represented by gap, deletion, fragment, centric function and polyploidy and spermatocytes were types autosomal, x-y univalent and polyploidy.

As the results show, tomato sheets containing sodium meta-bisulfite concentrations (0.335g/L) caused a highly significant increase in the mean value of chromosome aberrations in both bone marrow and spermatocytes cells. While tomato sheets containing sodium bisulfite concentrations (0.067g, 0.168g/L) were lower than those caused by the control. Tomato sheets containing vitamin C concentrations (0.330g/L) caused a highly significant increase in chromosome aberrations in both bone marrow and spermatocytes cells, while the concentrations (0.10g, 0.220g/L) were lower than those control, sub acute treatment caused high percentage of aberrant cells due to the accumulation effect of the tomato sheets containing sodium meta-bisulfite and vitamin C. centric fraction is the main type of chromosomal aberrations in both types of examined cells and the main type of chromosomal aberrations x-y univalent in spermatocytes were the most common chromosomal abnormalities in table (3 and 4).

The results obtained showed that, tomato sheets containing sodium meta-bisulfite concentrations (0.335g/L) caused significant increase in chromosome aberrations than the tomato sheets containing vitamin C concentrations (0.330g/L). The potency of sodium meta-bisulfite on the induction of chromosomal aberrations were highly significant than those caused by the vitamin C compared with control. In this study tomato sheets containing sodium meta-bisulfite concentration (0.335g/L) significantly induced chromosomal aberrations. This suggestion is in agreement with those found by Ashby and Ishidate (1986) who found that sodium salt was clastogenic to Chinese hamster lung (CHL) fibroblast cells in vitro.

Bhanot and Chambers (1977), and Chen and Shaw (1994), found that sodium metabisulfite converts to sodium bisulfite and sulphur dioxide when dissolved in water. Bisulfite (HSO<sub>3</sub>) causes the deamination of

cytosine in both double-stranded and single-stranded DNA and in RNA. Also Meng and Zhang, (1999) reported that bisulfite caused gene mutation under acidic pH and Na salt caused chromosomal aberrations. In addition bisulfite gave cytosine 5-methyleselfomate at pH 6-7. However, in this study sodium meta-bisulfite did not changed the medium pH (pH = 6.8-7.2). it was found that bisulfite induced the GPT mutations in CHO-AS52 cells. Also Meng and Zahang (1992), reported that bisulfite induced chromosomal aberrations, sister chromatid exchange and formation of micronuclei in human lymphocytes. As seen for the results of Pagano and Zeiger, (1987), bisulfite is a weak mutagen in *s. typhimurium* TA 97 and TA 1535 strains.

Popescu and Dipaolo, (1988) showed that sodium bisulfite induced a significant, but minimal increase in the sister chromatid exchange, however did not cause to the chromosomal aberrations in Syrian

hamster cells. Eyyup, et al., (2001a) reported that sodium metabisulfite induced the chromosomal aberrations and the sister chromatid exchanges, decreased the replication index and the mitotic index in human peripheral lymphocytes in a dose dependent manner. Eyyup, et al., (2001b) found that the effect of sodium meta-bisulfite (SMB) on mitosis was investigated in *Allium cepa*. The roots of *A. cepa* were treated. With SMB concentrations of 7.5mg/l, 15mg/l and 30mg/l for 10- and 20-hour treatment periods. SMB significant decreased the mitotic index (MI) at all concentrations and treatment periods. While the decreasing of the MI was dose dependent at 10hours treatment time, SMB increased the mitotic abnormalities dependently. In this study tomato sheets containing vitamin C concentrations (0.330g/L) caused highly significant increase in chromosomal aberration in bone marrow and spermatocyte cells.

**Table (3): Mean and standard error (frequencies) of chromosomal aberrations induced by tomato sheets containing sodium meta-bisulfite and vitamin C in bone marrow cells of mice.**

Treatment	No. of animal	No. of metaph examined	Structural aberrations					Total aberration (M±S.E)
			Chromatid gap (M±S.E)	Dilation (M±S.E)	Fragment (M±S.E)	Centric fuction (M±S.E)	Polyploidy (M±S.E)	
Control	5	250	0.20±0.20 <sup>E</sup>	0.20±0.20	0.40±0.24	0.20±0.20	0.00±0.00	1.00±0.63 <sup>D</sup>
SMBS (0.067g/l)	5	250	0.60±0.22 <sup>E</sup>	0.40±0.16	0.80±0.24	0.30±0.15	0.60±0.16	3.10±0.50 <sup>C</sup>
SMBS (0.167g/l)	5	250	4.20±0.66 <sup>B</sup>	1.20±0.20 <sup>B</sup>	5.80±0.72 <sup>B</sup>	0.80±0.24 <sup>B</sup>	2.20±0.53 <sup>B</sup>	14.80±0.85 <sup>B</sup>
SMBS (0.335g/l)	5	250	8.60±1.66 <sup>A</sup>	10.20±1.02 <sup>A</sup>	9.80±1.46 <sup>A</sup>	12.40±1.50 <sup>A</sup>	7.40±0.67 <sup>A</sup>	48.60±3.85 <sup>A</sup>
AA (0.110g/l)	5	250	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
AA (0.220g/l)	5	250	0.20±0.20 <sup>D</sup>	0.00±0.0	0.40±0.24 <sup>D</sup>	0.20±0.20	0.00±0.00	0.60±0.24 <sup>C</sup>
AA (0.330g/l)	5	250	0.00±0.00	0.00±0.00	0.40±0.16 <sup>C</sup>	1.20±0.29 <sup>C</sup>	20±0.20 <sup>C</sup>	3.20±0.42 <sup>C</sup>

SMBS = sodium metabisulphite

AA = ascorbic acid

Gruff et al., (1995) ; Jacob, (1999), found that the saturable kinetics of vitamin C make toxicity more likely when multiple large doses (1g) are consumed throughout a day versus one single dose. A common symptom of unabsorbed vitamin C left in the gastrointestinal tract is osmotic diarrhea. Vitamin C can be transformed in the body to oxalate, which is a common constituent of kidney stones. Doses up to 10grams have shown to be associated with a higher prevalence oxalate excretion, but the level does not fall outside of the normal range. As a precaution, people who are prone to kidney stones may want to avoid large doses 10times the Dietary References Index (DRI) or greater of vitamin C. people who lack the control to regulate iron uptake should also avoid large doses of the vitamin. As stated earlier vitamin C enhances iron absorption which can lead to toxicity of iron on some people. Furthermore, excess ascorbate in the urine and feces can falsify lab tests such as glucose in the urine and faecal occult blood test.

A number of possible problems with very large doses of vitamin C have been suggested, mainly based on in vitro experiments or isolated case reports,

including: genetic mutations, birth defects, cancer, atherosclerosis, kidney stones, rebound scurvy, increased oxidative stress, excess iron absorption, vitamin B12 deficiency and erosion of dental enamel. However, none of these adverse health effects have been confirmed, and there is no reliable scientific evidence that large amounts of vitamin C (up to 10grams/day in adults) are toxic or detrimental to health. With the latest recommended dietary allowance (RDA) published in 2000, a tolerable upper intake level in (ul) for vitamin C was set for the first time. A ul of 2grams (2, 000 milligrams) daily was recommended in order to prevent most adults from experiencing diarrhea and gastrointestinal disturbances. Such symptoms are not generally serious, especially if they resolve with temporary discontinuation or reduction of high-dose vitamin C supplementation.

According to these results, it can be concluded that sodium meta-bisulfite most probably poses a genotoxic risk. For this reason it is necessary to be careful when using it in food as antimicrobial substance and it is necessary to find new safe substances alternative to sodium meta-bisulfite.

**Table (4): Frequencies of chromosomal aberrations induced by tomato sheets containing sodium meta-bisulfite and vitamin C in spermatocytes cells in mice.**

Treatment	No. of animal	No. of metaph examined	Structural aberrations			
			Autosomal (M±S.E)	x-y univalent (M±S.E)	Polyploidy (M±S.E)	Total aberration (M±S.E)
Control	5	250	0.20±0.20 <sup>e</sup>	0.40±0.24 <sup>e</sup>	0.00±0.00	0.60±0.24 <sup>f</sup>
SMBS (0.067g/l)	5	250	0.20±0.13 <sup>e</sup>	0.80±0.24 <sup>e</sup>	1.40±0.22	2.40±0.22 <sup>e</sup>
SMBS (0.167g/l)	5	250	3.20±0.20 <sup>b</sup>	5.40±0.16 <sup>b</sup>	3.20±0.24 <sup>b</sup>	10.80±0.29 <sup>b</sup>
SMBS (0.335g/l)	5	250	8.00±1.58 <sup>a</sup>	11.20±1.11 <sup>a</sup>	6.60±1.03 <sup>a</sup>	25.80±1.53 <sup>a</sup>
AA (0.110g/l)	5	250	0.00±0.00 <sup>e</sup>	0.00±0.00 <sup>e</sup>	0.00±0.00 <sup>e</sup>	0.00±0.00 <sup>f</sup>
AA (0.220g/l)	5	250	0.20±0.20 <sup>d</sup>	0.00±0.00 <sup>d</sup>	0.40±0.20 <sup>c</sup>	0.60±0.25 <sup>d</sup>
AA (0.330g/l)	5	250	0.00±0.00 <sup>e</sup>	2.20±0.20 <sup>e</sup>	1.80±0.24 <sup>c</sup>	3.40±0.25 <sup>c</sup>

SMBS = sodium metabisulphite

AA = ascorbic acid



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1/2/2011

## The Contribution of Agricultural Cooperatives on Poverty Reduction: A Case Study of Marvdasht, Iran

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**Abstract:** The major objective of this paper is to emphasize the roles of agricultural cooperatives on poverty reduction in Marvdasht, Iran. Agricultural cooperatives can be significant economic players that contribute to sustained economic growth. The cooperatives provide the opportunity for poor farmers to raise their incomes and they are democracies empowering rural people to own their own solutions. The findings of this study found that agricultural cooperatives activities are seasonal and limits to provide some goods and services for farmers. This study also indicates some of the barriers of agricultural cooperatives in rural area of Marvdasht, Iran.

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**Keywords:** agricultural cooperative, rural development, poverty reduction

### Introduction

A cooperative is a business that is owned and controlled by the people who use its services and whose benefits are shared by the users on the basis of use (USDA, 2002). It is a group of people who work together voluntarily to meet their common economic, social, and cultural needs through a jointly owned and democratically controlled enterprise. Over 100 million jobs have been generated by cooperatives around the world. As agriculture remains the major source of income and employment in rural areas and the majority of cooperatives are found in the agricultural sector, cooperatives are significant in providing jobs to rural communities (ILO, 2007). An agricultural cooperative, known as a farmers' co-op, is a cooperative where farmers pool their resources in certain areas of activity (Wikipedia, 2011a). Agricultural cooperative is an association which individuals voluntarily organize to provide themselves and others with goods and services via democratic control and for mutually shared benefit (Birchall, 1997). Agricultural cooperatives have played an important role in rural communities, where they are an integral part of the social fabric. They encourage democratic decision making processes, leadership development and education (USDA, 2002). Cooperatives provide real economic benefits to farm families through increasing the stability of the farming sector, improving market access for their products and strengthening the farmers' position in the agri-food chain. Improving farmers' living conditions supports rural development and preserves the viability of rural communities. In Iran 28 million individuals in rural areas are members of or derive

benefits from agricultural cooperatives (ILO, 2007). Agricultural cooperatives are part of a dynamic environment. The nature of production agriculture changes daily. Many changes occur outside the cooperative system, which has little ability to directly influence them (USDA, 2002). Cooperatives too are often the only provider of services in rural communities given that traditional companies often find it too costly to invest in these areas or anticipate unacceptable levels of economic return (ILO, 2007). Agricultural cooperatives can play a key role in the development of rural areas in developing countries as well as in fighting poverty.

Agricultural cooperatives need to have membership and the potential to develop economically. This means that the farmer must be able to access sufficient land and affordable credit and develop knowledge and techniques. The farmer needs to access market information and networks. Subsistence farming does not normally provide scope for cooperative development and contributes little to poverty reduction. Differentiated strategies must be put in place to address the poverty of farmers. Rural poverty will not diminish dramatically as long as developing countries do not commit themselves to achieve better wealth distribution. In a couple of decades there will be far fewer people in the rural areas. However, the fight against poverty in the countryside will also very much depend on the macroeconomic development of the nations (Pinto, 2009). The major objectives of this paper are to:

- Emphasize the economic and non-economic roles of agricultural cooperatives on poverty reduction.

-Present and discuss the true contributions of agricultural cooperatives to the rural development  
 -Suggest policies and strategies for development of agricultural cooperatives in the region.

### Literature review

Poverty being a rural phenomenon where the majority of the people live in most developing countries, the mechanisms to be used should target the recipients. One of these methods which are used widely today is to organize people in form of associations or cooperatives (Adebayo et al., 2010). Agricultural cooperatives can help farmers get a better deal at various stages of production and distribution. Through membership of a co-operative farmers are collectively able to negotiate better prices for inputs, transport and storage facilities. Cooperatives can also help them expand access to markets and capture more of the value chain, for example by getting involved in processing activities (DFID, 2010). Cooperatives are based on the values of self-help, self-responsibility, democracy, equality and solidarity. Cooperative members believe in honesty, openness, social responsibility and caring for others (TFC, 2006). The role and potential of cooperatives have recently started to come to the fore again in discussions about poverty reduction (Simmons & Birchall, 2008). It is evident that agricultural cooperatives have significantly contributed to the mobilization and distribution of financial capital by creating employment and income-generating opportunities (Wanyama, Develtere, & Pollet, 2008). An agricultural cooperative is considered as one of the important economical and social organizations in rural societies. It plays an important role in the agricultural development through providing the farmers with production inputs, such as fertilizers, seeds and chemical substances, etc. In addition, it holds guide symposiums for the farmers to acquire them with the necessary knowledge and skills about the agricultural new methods that aim at increasing the agricultural production and, therefore, promoting the rural society. Agricultural cooperatives also have a significant role of rural development and poverty reduction as well (Aref, 2011).

Over time agricultural cooperatives may create social capital among their members at a greater rate than among shareholders of investor-owned firms. Social capital can be developed by agricultural cooperatives and the amount of social capital within the organization theoretically will enhance economic efficiency and enhance long-term success (Fafchamps & Minten, 2002). Cooperatives tend to attract a greater proportion of unskilled workers and

managerial workers than business enterprise. In large part, this may be attributable to the notion among many cooperatives that, in order for a truly functioning democratic structure to operate, traditional, specialized management positions should be de-emphasized because they place non-managers at a disadvantage regarding the development of skills and access to information necessary for decision-making capabilities. Rather, cooperatives, by comparative standards, emphasize the development of decision-making capacity for all its members (Abrahamsen, 1976; Aref, 2011; Roy, 1964). The agricultural cooperative system is designed to be the network structure. Member farmers running their farms independently for their own benefits are banded together voluntarily as one entity, a cooperative for their mutual benefits, participating in cooperative business as customers and owners and acting collectively (Fafchamps & Minten, 2002). Cooperatives are user-driven businesses that have contributed greatly to the development of one of the world's most productive and scientific-based agricultural systems. They have played an important role in strengthening market access and competitive returns for independent farm operators during the 20th century (USDA, 2002). The contribution of agricultural cooperatives for poverty reduction can be summarizing as a below description:

- Contribute to sustained growth processes
- Create more equitable growth.
- Tackle rural poverty.
- Provide an opportunity for poor people.

However in many countries the agricultural cooperative faces major challenges: poor management, low levels of supervision and political interference. While agricultural cooperatives are often huge in terms of membership and loan portfolios they are subject to very limited prudential supervision. In some cases cooperatives have been used as short term political tools – governments have sought to close them without providing compensation for savings lost and then later governments seek to promote them for electoral expediency. Many agricultural cooperatives are emerging from Government control (DFID, 2010).

Birchall (2003) has also noted that agricultural cooperatives' record for reducing poverty in developing countries is less than stellar, not due to shortcomings in the cooperative model, but rather due to external and internal constraints. The barriers are multiple and multifaceted: lack of autonomy due to government interference, inadequate access to markets, men typically hold membership and decision-making positions though women did most of the farming, and mismanagement. As these

constraints are overcome and an environment for the growth of cooperatives is established, the viability of cooperatives is greatly increased (Adebayo et al., 2010).

### Methods

Marvdasht is one of the northern cities and also counties of Fars province. The city is located 45 kilometers north of Shiraz and has an altitude of 1620 meters above the sea level. The county has an area of 3687 square kilometers. Marvdasht as a county is divided into four districts: Central, Kamfirouz, Doroudzan and Seydan. Marvdasht has a cold weather in the hilly areas and moderate climate in other regions (Wikipedia, 2011b). Agriculture is the major development sector in Marvdasht.

This study is based on quantitative method to investigate the contribution of agricultural cooperatives on poverty reduction and the barriers of agricultural cooperatives as well. Focus group discussion (FGD) was performed to collect data from the farmers in twelve villages in Marvdasht, Iran. Focus group was used for obtaining a better understanding of participants' attitudes (Aref, 2010). All respondents were male. They were chosen because of their engagement in agricultural activities. Eighty four people were participated in FGD. They ranged in age from 23-79 years.

### Result and Discussion

According to the collected baseline data, there were overall 84 participants with an average of 59 years old. The questions were asked about to contribution of agricultural cooperative on poverty reduction. They believe that the role of agricultural cooperatives is seasonal and in fact, they do not have important role on poor farmers. The below description has been provided through FGD.

- Farmers' participation in agricultural cooperatives planning is not considered. Decisions making in agricultural cooperatives policy are mostly made by government. In fact the lack of really farmers' involvement in the decision-making and unable rural power that exist to create a decision making for development cooperatives for poverty reduction.
- Most participants in FDG groups mentioned to lack of resource in the villages as main obstacles to agricultural cooperatives for poverty reduction.
- Involving the government to provide funding for agricultural cooperatives.
- Poor management: The cooperatives managers are without adequate knowledge for the cooperatives.
- FGD respondents believed the lack of culture of collaboration among local people was behind the failure investment for poverty alleviation. The

individualism is the one feature of Iranian culture. Hence, in this situation the collaboration in cooperatives cannot be success.

-The cooperative members often have low levels of literacy and little knowledge of their rights and responsibilities. As a result many cooperatives suffer from poor management and business skills.

-The farmers through FGD though the role of agricultural cooperatives is to distribution of some goods for farmers. Hence, they weren't aware about role of cooperatives. It also can have an effect on the apathy regards rural residents' participation in rural cooperatives.

Through the findings of this study these barriers were identified: Poor management, lack of resources, lack of autonomy due to government interference, inadequate access to markets, lack of collaboration culture, lack of cooperatives leaders' knowledge, dependently of cooperatives to government, were an important element contributing to limited agricultural cooperatives for poverty alleviation. As have been mentioned by Jamieson and Nadkarn (2009), the agricultural cooperatives has some barriers related to poverty reduction in Asian countries. Hence this argument has been confirmed by this study. According to the findings, the level of contribution of agricultural cooperatives in poverty reduction in Marvdasht, Iran is not acceptable. In considering the application of agricultural cooperatives in poverty reduction, the role of the rural leaders deserves consideration. Important role of leaders with respect to the cooperatives would include facilitating; encourage participants, encouraging learning, and developing local skills in rural areas (Aref,2011).

### Conclusion

Agricultural cooperatives can be significant economic players that contribute to rural economic growth. Cooperatives provide the opportunity for poor farmers to raise their incomes. The purpose of this article has been to demonstrate the contribution of agricultural cooperatives on poverty reduction in Marvdasht, Iran. Overall the findings indicated that poor management, lack of capacity, lack of awareness, lack of autonomy due to government interference, inadequate access to markets as main barriers of agricultural cooperatives related poverty reduction. Findings indicated the importance of farmers' participation in agricultural cooperatives to achieve the development goals. Hence, to avoid breakdowns, farmers' participation needs to be constantly encouraged. Therefore, various methods such as cooperative education could be applied to foster farmers' participation.

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## Social dimensions of Information and Communication Technologies (ICT) diffusion in rural communities in developing countries

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**Abstract:** In rural Internet and other information communication technologies (ICT) are mainly used by young, educated, well paid and urban consumers. Elderly, low-educated, low-paid and rural residents are among those who use the Internet the least. In our post-modern network society they are at the risk of social exclusion. This paper is aimed at the analysis of ICT diffusion in rural communities of Lithuania, exploring the main social patterns of diffusion and characteristics of rural Internet users. The study is based on focus group discussions and questionnaire-based survey of Lithuanian rural residents. The paper discusses types of change agents involved in the processes of ICT diffusion in rural communities and the main motives for using the Internet. It also explores the impact of ICT on ways of private communication and communication with relevant public authorities, discusses both positive and negative attitudes to ICT use in everyday life activities.

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### Introduction:

Information society is one of the major visions that characterize the end of 20th and the beginning of 21st century. This new type of society is described as “a new social and economic paradigm restructuring the traditional dimensions of time and space within which we live, work and interact” (Loader 1998:3). Information communication technologies as itself do not change the social structure; the force for change is provided by the use of ICT in all spheres of everyday life activities. Information and knowledge we get by means of the Internet empower individuals to participate successfully in nowadays society’s life. Thus unequal opportunities to use the Internet and other ICT are tightly related to an issue of social exclusion.

Technologies (ICT) during the past two decades have had many points of contact with education and training. The development of technology is placing new demands on expertise, and it is also leading to the increased use of information technology (IT) in instruction and learning. As early as in the 1970s discussions of the future of school systems started to pay attention to the opportunities provided by ICT. Now with the approach of the new millennium, IT is playing an increasingly central role

in almost all future planning of schools and instruction. (World Bank, 1999).

With the help of state and local funding, information technology has been purchased for schools ever since the 1980s. The state has also found many ways to support teacher training in the use of IT, and it has also allocated funds for the production of IT programs. Instruction in the use of IT has also played an important role in teacher training organized by local school authorities (Becker, 2000).

There are two opposite perspectives on the role of ICT in society. One part of scholars views computers and the Internet as magic entities with the power to transform society. They consider the Internet as a new medium of communication, helping to cope with issues of social exclusion, social inequality. According to Manuel Castells (2002: xxxi), this is one of the reasons “why, after three decades of existence, it emerged from specialized communities in the world of researchers, techies, hackers, and countercultural communities, to catch fire in business and in society at large”. But there are others who consider the new ICT as a tool to strengthen social inequality and widen the information gap, when one part of the population (haves of information) uses digital devices, while the

other part of the population (non-haves) is in a digital divide.

### Approaches to ICT diffusion:

The diffusion of innovations has been a focus of many research and scientific studies from diverse academic areas (Roger 2003). There were over 1500 diffusion oriented studies even during the 1950s and 1960s and research areas ranged from anthropology, rural sociology, medical sociology to educational or mass media research (Harper 1989:111). As Charles Harper (1989:111) notices, research findings in these diverse areas have been “remarkably consistent and cumulative”.

Diffusion theories suggest that there are several types of factors affecting the spread of innovations. Emphasizing different sets of factors, theoretical perspectives offer the ways how to analyze the dissemination of new technologies, ideas, reforms or products. The recent spread of information communication technologies in society has raised new aspects in diffusion research.

According to Paul Attewell (1996:204), two main metaphors or images are prevalent in diffusion research. He classifies the diffusion theories into 2 main categories: (1) adopter studies, and (2) macro-diffusion theories.

The first group implies theories which explain the patterns of innovation diffusion in relation to communication flows. The diffusion research focuses on adoption by individuals (or by single organizations) and investigates the impact of such factors as the nature of innovation, characteristics of adopters, diffusion networks and other. (Attewell 1996, Harper 1989).

The most widespread theory of innovation diffusion is presented by Everett Rogers. According to this theory, diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers 1983:5), thus the main 4 elements, which are identifiable in every diffusion research study, are (1) an innovation, (2) communication through certain channels, (3) time and (4) members of social system.

The first element – innovation - is considered to be any idea, practice, or material artifact perceived to be new by the adopting organization or individual (Rogers 1983). In our case, we analyse ICT communication through certain channels among the members of rural communities.

The potential adopters can find about new ideas just in case they are informed about them, thus the diffusion process implies the second element - communication through certain channels. According to Rogers (1983), innovations such as ICT can be transmitted to the receiver using 2 types of

communication channels: (1) interpersonal channels, and (2) mass media channels.

First type implies direct (e.g. face-to-face) communication between transmitter and receiver; and the second type includes governmental policies communicated through TV, radio, newspapers, etc. This existing discourse makes an impact on beliefs and attitudes of people toward ICT use and is one of the means for ICT diffusion among society members.

The second group of theories - macro-diffusion theories – examines the diffusion of new technologies across entire populations, communities, society. Speed of adoption depends on such factors as population size of an area, the distance of that area from other centers of population (Attewell 1996:205).

John Carey (1996) distinguishes marketplace factors as a separate group in diffusion research. This group includes pricing policy, replacement cycles. The price of innovation (new product, technology, service, etc.) has an important role in the process of adoption by the public. Generally new products are introduced at a high price, as early manufacturing is more expensive (due to the costs associated with the research and development of the product, low scale of production). As John Carey (1996) argues: a new technology has to find some early users who are able and willing to pay a high price for the product or service in order to achieve the economies of scale in manufacturing that can reduce the price for the general public.

The mass production reduces the costs and the price of the product. Typical examples of such pricing policy are introduction of radio, black white and color TVs, telephone connection. The initial price of the new technology was very expensive for an average household and the technology was not widely used, but the decrease in price resulted in a wider adoption.

But, as John Carey (1996) argues, the personal computer has followed a different pricing pattern: “rather than drop the price of personal computers, manufacturers have increased the capabilities of PCs each year”. Replacement cycles are also important. The growth of some technologies is linked to the purchase of other media. In this sense, replacement cycles for existing media can provide an important way to introduce new media. For example, in U.S. households, the average color TV is replaced after 8 years, the average telephone answering machine after 5 years and the average personal computer after 6 years (Carey 1996).

### ICT and social exclusion:

Information technology is the core element analyzing the new, global, knowledge-based society. In today's world the use of ICT becomes one of the

most influential factors that determine both the present performance and the future conditions for the person. The Internet offers a variety of ways for interaction. Lelia Green (2001:197) distinguishes 3 ways of interaction: (1) information access and retrieval, (2) private interactive communication with individuals or small groups and (3) public interactions. But unequal opportunities to use the Internet eliminate this variety of interaction. When we talk about the impact of new information communication technologies on the society, we analyze mainly two aspects of impact– networked or socially excluded people.

Contemporary scientists have formulated the terms like information poor and information rich (Green 2001). An approach like this emphasizes the circumstances of people with access to minimal or large amounts of information. People who do not have or have limited access to information resources (non-haves of information or information poor) are in the social position lower than information rich. The policies based on the idea of fundamental equity are that all people should have “trouble-free access to information” and this will promote equality (Green 2001:105).

Of course, not everything depends on the access: “Access to technology does not necessarily lead to its use, and information does not necessarily fuel self-empowering activity” (Green 2001:105). As Lelia Green argues: access is a necessary, but by no means sufficient, condition of equitable participation. To talk simply in terms of equity of access ignores the fact that effective interaction in the information society requires high levels of motivation and sustained effort. Such keenness to interact with the technology of information cannot be assumed. Continuing motivation is perhaps the key determinant of successful participation – more important than access per se (Green 2001: 104). The diffusion of ICT and adoption in everyday life activities such as e-learning, ecommerce, e-banking, etc. are rather complicated phenomena, depending on various characteristics of an individual and a certain social system.

Considering the use of the Internet, it is obvious that socio-demographic characteristics determine a gap between different groups of the population. According to the data of a survey Digital Lithuania 2001, performed in the framework of a study Lithuanian Information Society, carried out by The Open Society Fund (Šaulauskas, 2001), the Internet and other information technologies are mainly used by young, educated, well paid and urban consumers. The statistical data of this survey showed that people at the age of 15 – 49, who have acquired higher education or live, or aim at living in Vilnius,

Kaunas and other major cities of the country, and have high income are the most involved in the processes of information society development (Šaulauskas, 2001).

According to the statistical data, the lowest awareness of the processes and opportunities of information society development is among the Lithuanians over 60, who have acquired secondary or special secondary education, live in villages, rural centres or towns and have rather low income (Šaulauskas, 2001). It is obvious that different socio-demographic characteristics have determined a gap between different groups of the population. This can lead to the information gap, when one part of the population uses digital devices, while the other part of the population is in a digital divide. Thus the residents of rural communities are at the risk of being in a digital divide or even in a social exclusion.

### Conclusions

This study contributes to an analysis of ICT diffusion in rural regions and deals with the problems of social exclusion. It allows some conclusions to be drawn about the role of the Internet in rural communities. Communities' members are the most likely to use the Internet in order to get information, for e-mail communication, and for educational purposes (e-learning).

This study suggests that rural residents consider the Internet as a useful mean and new opportunity for being involved in everyday life processes. But also they indicate some obstacles that ICT diffusion meets in Lithuania. Non-equal ICT infrastructure at regional level, the low number of professionals who maintain the network and provide ICT service in rural regions of Lithuania, lack of knowledge in foreign languages, and relatively high costs of ICT (the prices for the Internet access or personal commuter's both hardware and software) are the main obstacles for rural residents to use the Internet.

Public access is emphasised as one of the ways in making the Internet available to greater numbers of individuals and firms in rural regions of Lithuania. Statistical data show that socially excluded groups (retired, elderly and unemployed people) use the Internet very little or do not use it at all. This case study also suggests that the methodology of the pilot study should be revised, because it is quite complicated to answer the question about the impact of ICT on social exclusion. Data show that people consider that there is a threat of social exclusion of some groups (ICT non-users) in Lithuania. But they are also positive about the role of the Internet in solving problems of exclusion. The use of the Internet is considered as an effective mean to integrate socially excluded people into society's life,

because living in rural region is not the key issue for being excluded.

A common strategy in higher education ministries in developing countries is public and private sector partnership in strategy or pursue rapid ICT projects is based. This partnership has different forms such as grant aid private sector interaction with public assistance, donated educational equipment and components by companies to public schools, providing technical assistance for planning, management and consolidation tools and human resources at the local level. But after financial aid, testing programs based on ICT is critical.

Many of the ICT training programs based on the charitable agencies aid have been unable to have high durability. Because the government has failed in its financial assistance in this situation none of the local communities to provide resources do not needed to continue these programs. Two strategies in here "to support government and local communities to move" are important. Since the 21st century, is century of education support about youth in Asia, to find sustainable ways to bridge the digital age in Asian countries is a real priority. And work through partnership that local leaders and guides are experts it can be lasting forever.

Several recommendations that emerged from the discussions emphasized on the need to think of ICT in education beyond computer aided learning and investigate the potential other technologies like community radio and other medium. These mediums could not only be cost effective but also has a greater outreach potential. It was also pointed out that low cost software solutions for e-learning that have scopes for innovation, should be incorporated in large scale projects. With an indication to open source solutions, the sessions recommended that such solutions should become a part of the overall policy for implementing technology supported education interventions.

Sustainability and scalability of project are also issues that needed serious considerations. While moving beyond the pilot and experimental phase, projects especially those that needs a considerable financial contribution should have a viable sustainability model for up scaling. It was also recommended that implementers needs to be cautious when selecting areas for implementing ICT in education projects.

Projects should also not lose priority of the education objectives. In some cases ensuring school accountability system and teachers attendance may be more important that investing time and resources in ICT integration in schools. One fact that emerged in the sessions was that ICTs effectively computers, initiated in government department and schools were

being used as decision support in education. Essentially, clear criteria, norms and standards needs to be developed for the information that was being used for decision-making.

This paper is a multidisciplinary study of ICT initiatives for rural development. It emphasizes adoption of a more systematic approach for integrating Traditional Knowledge Systems (TKS) and ICT inputs to ensure sustainability of rural e-governance projects. The study of literature related to rural development and e-governance has indicated various issues impeding success of such initiatives. The main issues are lack of localization of content for rural communities and inadequate participation of rural communities in design of rural ICT initiatives. The study therefore suggests the use the systems-approach to integrate the relevant TKS along with ICT initiatives in the design of e-governance systems for rural development. This participatory approach can lead to creation of more acceptable and sustainable e-governance projects.

Regardless of the wide differences in ICT access between rich and poor countries and between different groups in the country, there are concerns that challenge the application of ICT in education with the existing differences among the lines of economic, social, cultural, geographic and gender will be broader. Everyone equal opportunities in terms of suitability for participation are necessary, but access to various factors, either as users or as producers through their sources is difficult and heavy. Therefore, the primary differences enhance and even grow. Consequently, programmers' international education is faced with a difficult challenge and how to help solve the problem and its development.

Promoting ICT in education, when done without careful study, can lead to the marginalization of those with more favorable conditions are unknown. For example, "women compared with men, because of illiteracy, lack of higher education, lack of time and mobility and poverty, controlling access to ICT and fewer opportunities for training are relevant. Also, more boys than girls' access to computers at home and school are not strange to say that if more boys than girls are willing to work with computers. The report of the University Association of American Women is that "Although some girls have an important gender gap have been limited, but today's technology, technology club, and boys in public schools while its own problems and programs are settled girls use computers for word processing the brand". In an assessment in four African countries, the activities organized by World links remote international cooperation on projects between

teachers and students in developing countries will promote, despite creating programs without regard to sex contacts, sexual inequalities remain Uganda and Ghana. In addition, while more girls than boys in relation to academic performance and advanced communication skills program will enjoy more than boys, but they were unable to perform their technological skills were. A set of economic factors, organizational and cultural differences involved in the social.

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## Effects Of Aloe Vera (*Aloe Barbadensis*) Aqueous Leaf Extract On Testicular Weight, Sperm Count And Motility Of Adult Male Sprague-Dawley Rats.

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**ABSTRACT:** Aloe Vera has been widely reported for its numerous medicinal effects but little is known of its effects on the reproductive organs. This study investigated the effects of Aloe Vera aqueous leaf extract on testicular weight and semen parameters of Sprague-Dawley rats. Twenty- four adult male Sprague-Dawley rats weighing between 130-150 grams were divided into 4 groups. The experimental groups; B, C and D received oral doses of 30 mg/kg, 70 mg/kg and 100 mg/kg body weight of aqueous extract of Aloe Vera respectively; while, the control (Group A) received equal volume of distilled water for the duration of a complete spermatogenic cycle. The rats were sacrificed on the 57<sup>th</sup> day, the testes excised, weighed and processed for microscopic examination. The results showed that sperm count of rats that received 70 mg/kg and 100 mg/kg of Aloe Vera extract decreased significantly when compared with the control. However the decrease in sperm motility and testicular weight was not statistically significant across the groups. These results suggest that Aloe Vera has potential antifertility effects in the male rat.

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**KEYWORDS:** Aloe Vera, testicular weight, sperm count, sperm motility.

### INTRODUCTION

It is only in recent times that the renewed interests in natural products are being subjected to scientific method of testing. The use of Aloe Vera cuts across barriers of time and culture in the treatment of a broad range of illnesses. The basis of its reputation resides mainly with steadfast belief in claims of its curative properties, but without hard scientific evidence (Grover *et al.*, 2002).

Studies on Aloe Vera have largely upheld the therapeutic claims of anti-diabetic, anti- cancer and anti-biotic properties of this plant extract (Hu *et al.*, 2003; Kosif *et al.*, 2008). A study by Atherton (1998), showed that topically and orally administered Aloe Vera preparations to patients with chronic venous leg ulcers aid healing. It has also been reported that many diabetic subjects take the Aloe Vera gel because of its hypoglycaemic properties (Okyar *et al.*, 2001). However, it does not only possess hypoglycaemic properties but also has hypotensive, hepatoprotective and blood purifying properties (Tiwari, 2002). The antihypertensive effect of chemical constituents from Aloe Vera was also reported to cause 26 %, 52 % and 79 % reduction in mean arterial blood pressure at corresponding doses of 0.5, 1.0 and 3.0 mg/kg Aloe Vera in rats (Saleem *et al.*, 2001).

A report in "Clinical review" 1987 showed that a compound "acemannan" found in Aloe Vera seem to have remarkable antiviral properties (Saleem *et al.*, 2001). Moreso, the phytochemical analysis of Aloe

Vera gel shows that it has the following compounds, polysaccharides, steroids, organic acids, antibiotic agents, amino acids and minerals, which has skin soothing and cells protecting effects (Chithra *et al.*, 1998).

In Nigeria, the Yoruba's call the Aloe Vera plant "Ahon- Erin". It is one of the best medicinal plants used in ancient times. It was seen as a "magic plant" because it had a potential cure for all incurable disease (Olowokudejo *et al.*, 2008).

Aloe vera seems to ameliorate the body's physiology. However, Atherton (1998) cautions against generalisation of complimentary treatment with Aloe Vera. It has been shown to be harmful during pregnancy due to the purgative effect of its constituent glycid (Lullmann *et al.*, 2005).

There is however scanty information on its effects on the reproductive system. The extracts of Aloe Vera are being used for many purposes with several claims of its efficacy (Hu *et al.*, 2003). Its possible beneficial effect on fertility or its anti- fertility effects have not been widely studied. The present study aims at determining the effect of Aloe Vera extract on the rat testes and semen parameters.

### MATERIALS AND METHODS

#### COLLECTION OF ALOE VERA

The plant was obtained from the Botany department NIHORT, Ibadan and authenticated with a

specimen deposited in the herbarium with voucher no-LUH 2764 Botany department, University of Lagos.

### PREPARATION OF EXTRACT

*Aloe Vera* extract was prepared from *Aloe Vera* leaf gel with slight modifications of the procedure by Grieve (1975). Mature, healthy and fresh leaves of *Aloe Vera* having a length of approximately 25 to 50 cm were washed with fresh water. The leaves were cut transversely into pieces. The thick epidermis was selectively removed. The solid gel in the center of the leaf was homogenized. The crude extracts were prepared freshly each time and administered orally. The dosing schedule used was once daily.

### THE EXPERIMENTAL ANIMALS

24 Sprague Dawley male rats obtained from Laboratory Animal center of the College of Medicine, University of Lagos were randomly selected. The rats weighed 130 g- 150 g and were about 10 - 12 weeks old. They were kept in metal cages at room temperature (27 °C – 30 °C) in the animal room of the department of Anatomy, University of Lagos and exposed to photo-periodicity 12:12. The rats were divided into 4 groups of six rats each. They were fed on rat pellet (Bendel Feed and Flour Mills Ltd) and had access to water *ad libitum*. The use of the animals was in accordance with the national law on animal care and use (Zimmerman, 1983) and approved by the Experimental Ethics Committee on Animals Use of College of Medicine, University of Lagos, Nigeria.

### THE EXPERIMENTAL PROCEDURE

The 24 rats were divided into 4 groups of 6 rats.

GROUP A: - Control group received distilled water orally

GROUP B: - Received orally 30 mg/kg b.w. of fresh extract *Aloe Vera* daily for 56 days.

GROUP C: - Received orally 70 mg/kg b.w. of fresh extract of *Aloe Vera* daily for 56 days.

GROUP D: - Received orally 100 mg/kg of fresh extract of *Aloe Vera* daily for 56 days.

The groups were subjected to the same feeding regime and also weighed weekly.

At the end of the experimental period, the rats were sacrificed and the scrotal sacs were opened, the testes removed, trimmed of fat; and the cauda epididymides were removed for seminal analysis.

### Sperm Motility Analysis

The slides on which the sperm cells were counted were warmed to 37°C until the time of the analysis. The analysis was carried out at room temperature using one epididymis of each rat.

The percentage of sperm motility was calculated using the number of live sperm cells over

the total number of sperm cells (both motile and nonmotile), from two samples from one epididymis of each rat. All sperm cells that were not moving at all were considered to be nonmotile, while the rest, which displayed some movement, were considered to be motile (Yan *et al.*, 2007).

### Sperm count

This was achieved using the new improved Neubauer's counting chamber (Haemocytometer). The epididymal fluid was diluted with normal saline by adding 0.9 ml to 0.1 ml of the crushed epididymis. The counting chamber was next charged with a cover slip until a rainbow picture was seen at the edges. This chamber was then filled with sperm fluid and placed under a binocular light microscope using an adjustable light source. The ruled part was then focused and the number of spermatozoa counted in five 16-celled squares. The sperm concentration was then calculated and multiplied by  $10^6$  and expressed as  $(X) \times 10^6/\text{ml}$ , where X is the number of sperm in a 16-celled square (Akang *et al.*, 2008)

### RELATIVE TESTICULAR WEIGHT

Testicular weights (g) were measured before immersing in 10 % buffered formalin using an electronic weighing balance. The testicular weights were recorded as g/kg body weight.

### STATISTICS

The data obtained were expressed as Mean  $\pm$  Standard Error of Mean. The statistical tool used is one-way ANOVA, with  $p < 0.05$  considered significant. This was done using the SPSS software.

### RESULTS

There was a significant decrease in sperm count of groups that received 70 mg/kg and 100 mg/kg b.w. of *Aloe Vera* crude extract compared to control ( $p < 0.05$ ). Sperm count were also reduced in the group that received 30 mg/kg b.w. of the extract  $p > 0.05$  (TABLE 1). The sperm motility (TABLE 1) and relative testicular weights (TABLE 2) of the experimental animals showed an insignificant decrease across the groups compared to control.

**TABLE 1 – Effect of Aloe vera on Sperm Count and Sperm motility.**

Groups	Sperm Count (Millions/ml)	Sperm Motility (%)
A	62 $\pm$ 1.85	70 $\pm$ 11
B	61 $\pm$ 2.23	65 $\pm$ 13
C	54 $\pm$ 2.41*	65 $\pm$ 13
D	40 $\pm$ 2.48*	60 $\pm$ 13

Values are mean  $\pm$  standard error of mean, \*  $p < 0.05$  vs. control group

TABLE 2 – Effect of Aloe vera on testicular weight

GROUP	MEAN $\pm$ S.E.M (g/kg)
A (control) n=6	0.0076 $\pm$ 0.01
B	0.0080 $\pm$ 0.01
C	0.0081 $\pm$ 0.01
D	0.0080 $\pm$ 0.02

Values are mean  $\pm$  standard error of mean, \*  $p < 0.05$  vs. control group

S.E.M. = Standard Error of Mean

n = number of rats / group

## DISCUSSION

Our findings in this study are in accord with the observation of Lang (1993), who observed impairment of fertility as one of the major precaution in the use of the plant Aloe Vera. This study buttresses this point as it demonstrates that Aloe Vera has deleterious effect on testis. This findings is however at variance with Maurice (1993) who reported that a dose of 60 mg/kg b.w. aloe vera powder increased both the fertility rate and the litter size of rabbits.

Aloe Vera was also discovered to act as a biological active vehicle for hydrocortisone acetate, which was tested topically and systematically against acute inflammation (Davies *et al.*, 1991). Anthraquinones is another strong compound in Aloe Vera that is responsible for purgative and laxative in their pure forms which may cause hypoglycaemia (Lullmann *et al.*, 2005; Vinson *et al.*, 2005). This could have ultimately resulted in metabolic alteration affecting the production of sperm cells leading to the low sperm count and sperm motility across the groups (Ballester *et al.*, 2004; Vavaiya *et al.*, 2007).

The studies also revealed a decrease in testicular weight, sperm count and sperm motility in contrast with the findings of Nwanjo (2006) who reported that Aloe Vera is rich in antioxidants which reduce lipid peroxidation and mops up free radicals. The decrease in testicular weight could be attributed to the decrease in the production of sperm cells from the testis. This may have been as a result of reduction in seminiferous tubules which makes up about 80% of the testicular volume.

## CONCLUSION

The administration of Aloe Vera to adult male rat at therapeutic dose of 30 mg /kg. b.w. /day over a period of 56 days has no effect on testicular weight, but mild to moderate reduction in testicular weight were observed at doses of 70 mg/kg and 100 mg/kg body weight of Aloe Vera extract.

Aloe Vera reduced sperm count and motility hence, it could serve as a contraceptive drug.

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## An Investigation on Fuzzy Numbers

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**Abstract:** Ranking fuzzy numbers plays an important role in a fuzzy decision making process. However, fuzzy numbers may not be easily ordered into one sequence due to the overlap between fuzzy numbers. A new approach is introduced to detect the overlapped fuzzy numbers based on the concept of similarity measure incorporating the preference of the decision maker into the fuzzy ranking process. Numerical examples and comparisons with other method are straight forward and are practically capable of comparing similar fuzzy numbers. The proposed method is an absolute Ranking and no pair wise comparison of fuzzy numbers is necessary. Furthermore, through some examples discussed in this work, it is proved that the proposed method possesses several good characteristics as compared to the other comparable methods examined in this work.

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**Keywords:** Fuzzy numbers; Fuzzy ranking; Decision making

### 1. Introduction

Fuzzy set theory (Zadeh, 1965) has been extensively applied to solve decision-making problems in a fuzzy environment where the measurements of alternatives are imprecise in nature. The imprecise numerical measurements of alternatives are often represented by fuzzy numbers. Thus, comparing the alternatives is based on the comparison of their corresponding fuzzy numbers (Chen, 2001).

Fuzzy ranking is used to deal with the ordering of fuzzy numbers. Fuzzy numbers may be similar to each other in the problem; thus, the ranking process must be capable of distinguishing the similarity of fuzzy numbers. In addition, the need for comparing the similar fuzzy numbers is likely to grow when the problem size increases (Tseng, 1989). This reflects that efficiency should be of priority concern in the ranking process. In summary, the selection of a good fuzzy ranking method should satisfy the following criteria (Nojavan, 2006):

- Rationality of preference ordering– the consistency of ranking results with the decision maker's intuition
- Robustness- the ability to rank the fuzzy numbers with different shapes and using all information represented by the whole possibility distribution of fuzzy numbers
- Efficiency– the simplicity of computational process
- Fuzzy preference presentation– the ability to facilitate the representation of decision maker's viewpoint

Many fuzzy ranking techniques have been proposed in the literature. (Bortolan, 1985), (Chen, 1992), (Lee, 1988) thoroughly reviewed the existing methods and pointed out some illogical conditions embedded in these methods, such as producing

counter-intuitive ranking orders, lack of discriminative ability, complex and considerable computational efforts. In recent studies, (Chen, 2001) used the left and right dominance to mark fuzzy numbers. (Chen, 2002) proposed a new method for ranking fuzzy numbers using  $\alpha$ -cuts and signal/ noise ratio. (Deng, 2006) presented a modified area method to rank fuzzy numbers. Fuzzy ranking can be achieved by calculating the similarity between two fuzzy sets (Wang, 1997). Measure of similarity between two fuzzy numbers depends on the subjective preference from different weighting members in the fuzzy numbers (Wang, 1997). Preference reveals the view and interest of the decision maker about the ordering of the fuzzy numbers and is always considered important to handle decision problems. With regard to the similar concept, (Lee, 1988) suggested that the fuzzy numbers with larger mean and smaller spread are ranked at higher position. Among the existing ranking methods, however, most of these measures are limited to incorporate the preference of the decision maker into the ranking process.

Thus, a new method will be proposed based on this concept. The remaining sections of this paper are organized as follows. The concept of using the preference to solve the fuzzy ranking problem will be described in the next section. In section 3, the proposed model will be developed and analyzed to compare a variety of fuzzy numbers. The proposed algorithm for ranking fuzzy numbers will be demonstrated in section 4. Then, the new algorithm will be verified by testing it through some previously reported examples. The last section is devoted to certain concluding observations.



## 2. Fuzzy Ranking Using Preference

Before the preference model is discussed, some basic concepts of fuzzy numbers are briefly reviewed. Let  $A_i$  be any one of  $n$  normal fuzzy numbers to be compared and is represented as  $A_i = \{x, \mu_{A_i}(x), x \in \mathfrak{R}\}$ , where  $\mathfrak{R}$  is the universe of discourse and  $\mu_{A_i}(x)$ ,  $0 \leq \mu_{A_i}(x) \leq 1$ , indicating the degree of membership of  $x$  in  $A_i$ , can be defined as:

$$\mu_{A_i}(x) = \begin{cases} \mu_{A_i}^L(x) & a \leq x \leq b \\ 1 & b \leq x \leq c \\ \mu_{A_i}^R(x) & c \leq x \leq d \\ 0 & \text{other wise} \end{cases}$$

where  $\mu_{A_i}^L(x)$  is the left membership function that is an increasing function and  $\mu_{A_i}^R(x)$  is real numbers? A normal trapezoidal fuzzy number is denoted by  $A_i = (a, b, c, d)$ , If  $b = c$ , then  $A_i$  is called a triangular fuzzy number.

Based on the relative position of fuzzy numbers on the real line, there exist two views, the indifference and the dominance, between fuzzy numbers  $A$  and  $B$  means the overlap area in which  $A$  and  $B$  intersect (i.e., fuzzy numbers  $A$  and  $B$  are indifferent to each other in the area); while the dominance means that if there exist one or more no overlap areas between fuzzy numbers, then for each no overlap area either  $A$  dominates  $B$  or  $B$  dominates  $A$ . As pointed out in (Tseng, 1989),  $A$  dominates  $B$ .

Therefore, the fuzzy ranking between fuzzy numbers in the nonoverlap case is very straightforward; the ordering of the fuzzy number in the right-hand side is preferred to the ordering of the fuzzy number in the left-hand side. However, it is more difficult to rank fuzzy numbers in the overlap case if there exist both dominance and indifference between  $A$  and  $B$ . The more Overlap areas between  $A$  and  $B$  (either  $A$  dominates  $B$  or  $B$  dominance  $A$ ) the more difficult to compare fuzzy numbers. Figure 1 illustrates the dominance situation in the no overlap case and the situations of dominance and indifference in overlap case of three fuzzy numbers. In the Figure, fuzzy numbers  $B$  and  $A$  and fuzzy numbers  $C$  and  $A$  are the nonoverlap cases where both fuzzy numbers  $B$  and  $C$  dominate  $A$  and are on the right-hand side of  $A$ , thus, fuzzy numbers  $B$  and  $C$  dominate  $A$  and are on the right – hand side of  $A$ , thus, fuzzy numbers  $B$  and  $C$  are preferred to  $A$ . On the other hand, it is more difficult to compare fuzzy numbers  $B$  and  $C$  are since situations of dominance and indifference (the shaded area between  $B$  and  $C$  in the Figure) exist in this overlap case.

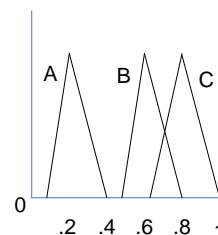


Figure 1. Dominance and indifference between fuzzy numbers

(Kang, 2006) incorporated the user preference to calculate the similarity between two fuzzy sets. The similarity measure  $S(D, Q)$  Computes the degree of overlap between two fuzzy sets  $D$  (a document) and  $Q$  (a query) at each membership degree and is defined as:

$$S(D, Q) = \sum_{\mu} f(\mu: D, Q) p(\mu)$$

Where  $f(\mu: D, Q)$  represents the overlap function at a membership degree  $\mu = [0, 1]$  between fuzzy sets  $D$  and  $Q$  and is defined as:

$$f(\mu: D, Q) = \sum_{i=1}^n \delta(t_i, \mu: D, Q)$$

Where

$$\delta(t_i, \mu: D, Q) = \begin{cases} 1 & \text{if } \mu_D(t_i), \mu_Q(t_i) \geq \mu \\ 0 & \text{otherwise} \end{cases}$$

Where  $t_i$  is a term in the index set  $I$ ,  $\mu_D(t_i)$  and  $\mu_Q(t_i)$  represent a measure of degree to which  $D$  and  $Q$  are characterized by each index term  $t_i$ . The value of  $\delta(t_i, \mu: D, Q)$  determines whether two fuzzy sets are overlapped at the membership degree  $\mu$  for index term  $t_i$ . Here,  $p(\mu)$  is a membership preference function. When the ranking results yield the same degree of similarity between two fuzzy numbers, the preference function is able to discern the two fuzzy numbers by focusing on the higher range of membership degree. The preference function is given a value of 1 if  $\mu_D(t_i) \geq \mu_p$  and a value between 0 and 1 otherwise. The symbol  $\mu_p$  is a preference threshold determined by the user to verify the degree of significance for the compared fuzzy numbers. The larger the value of  $S(D, Q)$  the more the similarity for two fuzzy sets.

## 3. Proposed Method

A new algorithm for ranking fuzzy numbers will be introduced in this section. The algorithm is developed based on the concept of similarity measure incorporating the preference of the decision maker into the fuzzy ranking process.

To compare the similarity between fuzzy numbers, a fuzzy reference set is applied for this purpose in this paper. The fuzzy reference set is used here since it is found an efficient way in comparing fuzzy numbers in some approaches among the existing ranking methods (Chen, 1985), (Yager, 1980). It can be applied to compare fuzzy numbers in a straightforward manner and provides a common comparison base for the absolute position of each fuzzy number. The fuzzy maximum and fuzzy minimum, representing the fuzzy reference set, will be utilized to calculate the similarity between the fuzzy numbers. The fuzzy maximum and fuzzy minimum, representing the fuzzy reference set, will be utilized to calculate the similarity between the fuzzy numbers. The idea is that a fuzzy number is ranked first if its similarity to the fuzzy maximum is large and its similarity to the number is ranked first if its similarity to the fuzzy maximum is large and its similarity to the fuzzy minimum is small. If the condition is satisfied by some fuzzy numbers at the same time, a fuzzy number might be outranked the other fuzzy numbers depending on the preference of the DM.

For the proposed method, the fuzzy maximum ( $M = (x, \mu_M(x), x \in \mathfrak{R})$ ) and fuzzy minimum ( $N = (x, \mu_N(x), x \in \mathfrak{R})$ ) are given

$$\mu_M(x) = \begin{cases} x & 0 \leq x \leq 1 \\ 0 & \text{other wise} \end{cases}$$

respectively by

$$\mu_N(x) = \begin{cases} 1-x & 0 \leq x \leq 1 \\ 0 & \text{other wise} \end{cases}$$

It is clear that the fuzzy maximum is the same as Yager's definition (Yager, 1980). The use of Yager's fuzzy maximum is because the absolute locations of fuzzy numbers can be incarnated automatically in the comparison process, resulting in comparable ranking values. The fuzzy minimum represents the set of small reference values with higher membership grades and is undesired by the decision maker. Based on the definitions of fuzzy maximum and fuzzy minimum, each fuzzy number is compared with the two fuzzy reference sets and two scores, the right score and the left score, are formed for the fuzzy number. Based on the similarity measure concept, the right score that compares the similarity of fuzzy number A to the fuzzy maximum is defined as  $S_M = (A, M) = \sum_{\mu} f(\mu : A, M) p(\mu)$ ,

where

$$f(\mu : A, M) = \sum_{i=1}^n \delta(x_i, \mu : A, M), \text{ where}$$

$$\delta(x_i, \mu : A, M) =$$

$$\begin{cases} 1 & \begin{cases} \min_{x_i \in \mathfrak{R}} (\mu_A(x_i), \mu_M(x_i)) \geq \mu \\ D(A \cap M, 0) \\ \mu_A(x_i), \mu_M(x_i) > 0 \end{cases} \\ 0 & \text{other wise} \end{cases}$$

$\min(\mu_A(x_i), \mu_M(x_i))$  represents intersection between A, M where  $\mu_A(x_i) = \mu_M(x_i) > 0$ .

$D(A \cap M, 0)$  is the Hamming distance measure, representing the area where A and B are indifferent. (Tseng, 1989) pointed out that the Hamming distance is the best way to express the difference concept in the fuzzy ranking process. That claim is therefore utilized in the formulation of the fuzzy ranking process. That claim is therefore utilized in the formulation of the fuzzy ranking index.

The Hamming distance between fuzzy numbers A and B on the interval in the real line is defined by:

$$D(A, B | S) = \int_{u \in S} |\mu_A(u) - \mu_B(u)| du$$

Where  $S = \mathfrak{R}$   $D(A, B | \mathfrak{R}) = D(A, B)$  that is  $D(A, B)$  represents the non overlap area where A dominates B while  $D(A \cap B, 0)$  means the area where A and B are indifferent.

The areas where A dominance B or B dominates A measure the Hamming distance between fuzzy numbers A and B on the interval in the real line. It is easy to identify the interval of dominance. However, finding this interval can be difficult for non convex fuzzy numbers. In addition, the significance of comparing non normal fuzzy numbers is unclear (Bortolan, 1985). Therefore, consider only the normal fuzzy numbers in this study.

The value of  $\delta(x_i, \mu : A, M)$  determines the overlap situation between fuzzy numbers A and M at  $\mu$  for a given support  $x_i$ . The decision maker provides a mechanism to reflect the preference of decision maker. Like, the left score that measures the similarity of the fuzzy number A to the fuzzy minimum is determined by

$$S_N(A, N) = \sum_{\mu} f(\mu : A, N) p(\mu) \text{ Where}$$

$$\delta(x_i, \mu : A, N) = \begin{cases} 1 & \begin{cases} \min_{x_i \in \mathfrak{R}} (\mu_A(x_i), \mu_N(x_i)) \geq \mu \\ D(A \cap N, 0) \\ \mu_A(x_i), \mu_N(x_i) > 0 \end{cases} \\ 0 & \text{other wise} \end{cases}$$

The use of both SM and SN guarantee the full utilization of the information in the fuzzy number. The SM and SN indicate the indifference of each

fuzzy number with respect to the fuzzy maximum and fuzzy minimum, respectively. A rational DM would prefer a larger  $S_M$  and a smaller  $S_N$ .

Finally, combine both scores obtained from the similarity measures between the fuzzy number and the fuzzy reference sets as a ranking index, representing the overall similarity measure of each fuzzy number, given by  $O_A = \frac{S_N}{S_M}$ .

That is, the smaller the overall similarity measure, implying the fuzzy reference sets. Based on the concept of overlap function, indifference between two fuzzy numbers can be measured by the number of intersections in the overlap area. Suppose  $A = (a, b, c)$  is a normal triangular fuzzy number and fuzzy number  $B$  represents the fuzzy maximum  $M$  or fuzzy minimum  $N$  in the proposed model. To determine the areas of overlap on the real line for fuzzy min  $(\mu_A(x), \mu_B(x)), \forall x \in \mathcal{R}$ , i.e., The number of times the fuzzy numbers intersect in the overlapped area, where  $\mu_A(x) > 0$  and  $\mu_B(x) > 0$ . The possible cases include two points of intersection and one point of intersection.

Case I. Two points of intersection. When comparing the fuzzy numbers  $A$  and  $M$ , two points of intersection can only occur if the support of  $A$  is included in the support of  $M$ , that is when  $0 < a \leq b < c \leq 1$  or  $0 < a < b \leq c < 1$ . Based on the overlap area between  $A$  and  $M$ , the overlap function can be found as follows:

$0 \leq a < b \leq c \leq 1$  or  $0 < a \leq b < c \leq 1$ . On the other hand, when the fuzzy number  $A$  is compared with the fuzzy minimum  $N$ , two points of intersection may exist if the support of  $A$  is included in support of  $N$ , that is when  $0 \leq a < b \leq c < 1$  or  $0 < a \leq b < c < 1$ . Thus, the overlap function is given by

$$\delta(x_i, \mu: A, N) = \begin{cases} 1 & \text{if } \min(\mu_A(x_i), \mu_N(x_i)) \geq \mu, \mu_A(x_i) > 0 \\ 0 & \text{otherwise} \end{cases}$$

Case II. One point of intersection

Let  $x$  be the point of intersection. One point of intersection is possible for the fuzzy number  $A$  and  $M$  if the support of  $A$  is contained in the fuzzy set  $M$  and when  $0 \leq a < n = v = 1, 0 = a \leq b < c \leq 1$  or  $0 = a = b < c \leq 1, 0 \leq a < b \leq c < 1$ . Therefore,

$$\delta(x_i, \mu: A, M) = \begin{cases} 1 & \left\{ \begin{array}{l} \text{if } \min(\mu_A(x_i), \mu_M(x_i)) \geq \mu, 0 \leq a < b = c = 1 \\ 0 = a \leq b < c = 1 \text{ or } 0 = a = b < c \leq 1 \end{array} \right. \\ 0 & \text{otherwise} \end{cases}$$

For a fuzzy number  $A$ , the algorithm of the practical approach for obtaining the overall similarity index can be summarized as follows:

Step1. Calculate the intersection points in the area where  $A$  and  $M$  are indifferent.

Step 2. Calculate the overlap function  $f(\mu)$  based on comparing the intersection points with the membership degree  $\mu$  between fuzzy sets  $A$  and  $M$ .

Step 3. Determine the preference function  $\rho(\mu)$ .

Step 4. Calculate the similarity measure  $S_M(A, M)$  between fuzzy sets  $A$  and  $M$ .

Step 5. Repeat Step 1 to Step 3 to calculate the similarity measure  $S_N(A, N)$  between  $A$  and  $N$ .

Step6. Calculate the overall similarity index for fuzzy number  $A$  by  $OA = \frac{S_N}{S_M}$ .

#### 4. A descriptive example

To describe the proposed method briefly, suppose there are five fuzzy numbers  $\{A_1, A_2, \dots, A_5\}$ , to be ranked, where  $A_1 = (0.6, 0.7, 0.7, 0.8)$ ,  $A_2 = (0.4, 0.5, 0.6, 0.7)$ ,  $A_3 = (0.2, 0.5, 0.5, 0.8)$ ,  $A_4 = (0.3, 0.4, 0.4, 0.9)$  and  $A_5 = (0.1, 0.2, 0.2, 0.3)$  as shown in Figure 2. By intuition,  $A_1$  is preferred to  $A_5$  or  $A_1 > A_5$  since they are nonoverlapped and  $A_1$  is on the right hand-side of  $A_5$ . Likewise,  $A_2 > A_5$  and  $A_4 > A_5$ . However, it is more difficult to compare fuzzy numbers  $A_1, A_2, A_3$  and  $A_4$  since they are overlapped to each other. Even some of them are too close to be distinguished, the ordering of fuzzy numbers can be decided by the proposed algorithm by comparing the similarity between each fuzzy number and the fuzzy reference sets.

The first step shows that there exist two intersection points in the overlapped area between  $A_1$  and  $M$ , which are 0.67 and 0.73, respectively. Suppose that the increment of membership degree used to calculate the overlap function  $f(\mu)$  is 0.1. Given that the value 1 is assigned to the preference function if  $f(\mu)_A(x) \geq 0.5$  otherwise. Then the right score for  $A_1$  is found by the following calculation:

$$S_M(A_1, M) = \sum_{\mu=0}^{1.0} f(\mu: A_1, M) p(\mu) =$$

$$f(0)p(0) + f(0.1)p(0.1) + \dots + f(1.0)p(1.0) = 15$$

Likewise, two intersection points present in the overlapped area between  $A_1$  is 3.5, which can be obtained by applying the same calculation procedures as those for the right score. Thus, the overall similarity index for fuzzy number  $A_1$  is determined from both scores as 0.233. Based on the proposed algorithm, it is clear that the final ranking is  $A_1 > A_2 > A_4 > A_3 > A_5$ , which is the same as in (Tseng, 1989). However, in the study of (Chen, 2001), the ranking order gives non-discrimination of two or three in this case, a fuzzy number in this example, either  $A_1 > A_2 > A_3 = A_4 > A_5$  or  $A_1 > A_2 = A_3 = A_4 > A_5$ . In this case, a fuzzy number may be preferable or equal to the other, depending on the preference of the decision maker.

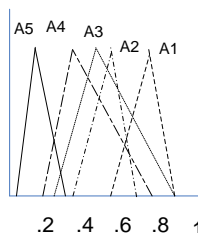


Figure 2. Fuzzy numbers for the descriptive example

When the decision maker increases the preference threshold from 0.5 to 0.7, the proposed algorithm indicates that the ordering for the five fuzzy numbers is changed to be  $A_1 > A_4 > A_2 > A_3 > A_5$ . Therefore, the proposed similarity measure can clarify the difference between fuzzy numbers in the ranking process in terms of the decision maker's preference. See Table 1.

## 5. Comparative examples

In this section, several typical examples are displayed to illustrate the validity of the proposed method. These examples are selected since the features they have can thoroughly test the ability of a ranking algorithm to differentiate between fuzzy numbers.

**Example 1.** Two triangular fuzzy numbers adapted from (Tseng, 1989) are ranked as shown in Figure 3, where the two competing fuzzy numbers share the right side and are different on the left side. This example challenges Jain's method, which only considers the partial information of fuzzy numbers being compared, especially those on the right-hand side. Since the lower values of the supports are ignored, this results in counter-intuitive

In addition, (Chen, 1985) noted that if some of the fuzzy numbers contain negative support values, then Jain's membership function becomes negative if the value of  $k$  is an odd integer. That contradicts the definition of membership function.

Although intuition would yield  $B > A$ , it is not surprising that no-discriminative results are seen using Jain's three indices. Bass and Kwakernaak's method gives a same result for this example while Yager's Hamming Distance method presents a counter-intuitive result. Chen's three indices give only one answer for this example.

Kerre's and the proposed methods give a fair ranking, in accord with human intuition.

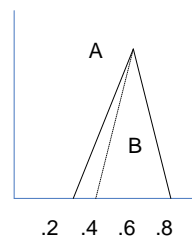


Figure 3. Fuzzy numbers for example 1

**Example 2.** Cited from (Chen, 1992), two fuzzy numbers and a crisp number are ranked as shown in Figure 4. For Bass and Kwakernaak's method, fuzzy number A is equal to fuzzy number B. The ranking order is  $A > B > C$  based on Yager's index, which would go against intuition. Note that the mixed comparison of fuzzy numbers and crisp, cannot obtain a consistent result using Jain's three indices. However, Chen's three indices give only one answer in this example. In the consequence,  $A < B < C$ , obtained by Kerre's and the proposed methods, complies with human intuition as suggested by (Chen, 1992).

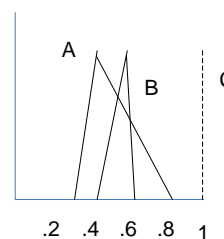


Figure 4. Fuzzy numbers for example 2

**Example 3.** Using the example from Chen (Chen, 1985), two triangular fuzzy numbers are illustrated in Figure 5. This example challenges Chen's method. A non-discriminative result is seen using Chen's method when  $k=1$ . Chen's method ignored the absolute locations of the fuzzy numbers

on the horizontal axis (Chen, 1992). As a result, Chen's method may not provide adequate discrimination ability for some fuzzy numbers that have the same relative position (Gonzalez, 1990). Since there contain situations of dominance and indifference in overlap between the fuzzy numbers, intuition in this example is not as obvious as in the previous examples. (Lee, 1988) pointed out that people would prefer a fuzzy number if it provides characteristics of showing higher mean value with smaller spread.

Based on the explanation from (Lee, 1988) pointed out that people would prefer a fuzzy number if it provides characteristics of showing higher mean value with smaller spread, fuzzy number A shows more satisfying characteristics than that of fuzzy number B in this example. However, this explanation is not seen from Bass and Kwakernaak's method and Yager's index. For Jain's method, as not all indices are identical, the DM needs to select which  $k$  to use in determining ranking order. Kerre's and the proposed methods favor fuzzy number A over B, complying with the result obtained by (Tseng, 1989), (Kolodziejczyk, 1986).

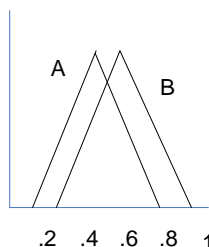


Figure 5. Fuzzy numbers for example 3

Example 4. Three triangular fuzzy numbers which have the same spread, cited from (Chen, 2002), are compared in this example as shown in Figure 6. A reasonable ranking  $A < B < C$  is given by

all methods, complying with the results suggested by (Deng, 2006).

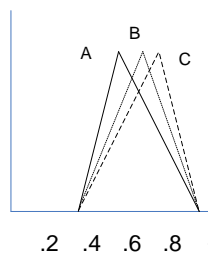


Figure 6. Fuzzy numbers for example 4

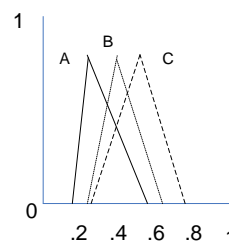


Figure 7. Fuzzy numbers for example 5

Example 5. Consider three triangular fuzzy numbers adapted from (Chen, 2002) are ranked as shown in Figure 7. All methods obtain the same ranking order  $A < B < C$  in this example. This conclusion correlates with that in (Chen, 2002).

In general, the proposed ranking method possesses good characteristics and advantages from the results in all cases as compared to other existing methods. It shows clearly from the cases tested above that the proposed method enables one to explain them more effectively than would be possible with the other methods.

Table 1. The overall similarity measures with varying  $\mu_i$  for  $A = \{A_1, A_2, \dots, A_5\}$  of Figure 1

Fuzzy Numbers	$\mu_p = 0.1$	$\mu_p = 0.3$	$\mu_p = 0.5$	$\mu_p = 0.7$	$\mu_p = 0.9$
$A_1$	0.467	0.367	0.233	0.304	0.467
$A_2$	0.833	0.833	0.842	0.833	0.833
$A_3$	1.00	1.00	1.00	1.00	1.00
$A_4$	0.818	0.727	0.889	0.818	0.818
$A_5$	3.40	6.80	6.80	6.80	3.40

## 6. Conclusion

Ranking fuzzy numbers has been realized as one of important topics in fuzzy set theory since it is a base of decision-making applications. However,

fuzzy numbers may not be easily ordered in one sequence because their magnitudes involve uncertain values. To ensure a reliable decision outcome, a rational ordering method becomes necessary.



Accuracy and effectiveness in determining proper outcomes are also considered as important characteristics. When ranking a large quantity of fuzzy numbers with limited information about them, an efficient fuzzy ranking method is tremendously significant. The preference based algorithm is developed in this paper to deal with the ranking of fuzzy numbers. Then new algorithm measures the similarity between the competing fuzzy number and the fuzzy reference sets by allowing the decision maker to assign the preference to the index calculation. The fuzzy reference set is used in the new model to determine the absolute location of fuzzy numbers. In addition, the full information contained in fuzzy numbers is used in the ranking process to obtain the overall ranking index for each competing fuzzy number. Through some examples discussed in this work, it is proved that the proposed method possesses several good characteristics as compared to the other comparable methods examined in this work. The computational process of the proposed method is straight forward and is practically capable of comparing similar fuzzy numbers. Furthermore, the proposed method is an absolute ranking and no pair wise comparison of fuzzy numbers is necessary, saving the computational time. The new algorithm also provides flexibility allowing the participation of the decision maker.

In general, the proposed method is an effective practical aspect which is not seen in several other methods. It is transitive in giving a consistent conclusion in the comparison of more than more than two fuzzy numbers, robust in providing a mixed comparison of fuzzy numbers and crisp numbers, and simple in the computational process. These features of the proposed method can be a valuable tool for comparing fuzzy numbers and used in many applications same as fuzzy control.

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## Role of Knowledge Management in Performance of the Forest, Rangeland, and Watershed Organization's managers in Iran

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**Abstract:** The purpose of this study is to evaluate the role of knowledge management in performance of the country's forest, rangeland, and watershed organization's managers. This is applied and non-experimental (descriptive) research. The methodology of research is correlation. Questionnaire is main instrument in research. Statistical population in this study was 300 executives of the Forest, Rangeland and Watershed of country; based on census, 239 respondents have completed the sent questionnaires. For measuring study tool's validity the questionnaire was given to researchers, experts, and the organization's managers associated with the subject in the ministry of Agricultural organization, and a primary-test by completing 30 questionnaires and for measuring reliability, the questionnaire was taken and the Cronbach alpha coefficient was 84 percent. The results showed that the organization's managers familiarity with knowledge management was weak and In regarding the prioritizing dimensions of knowledge management, identifying knowledge was in highest priority. Multiple regression results showed that using knowledge, preserving knowledge and acquiring knowledge variables determined 31.5% the performance of managers of the country's forest, rangeland, and watershed organization.

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**Keywords:** knowledge management, knowledge, managers, performance

### 1. Introduction

Organizational growth and development depends on its managers' good and efficient management. In this way, outfitting managers with various capabilities is considered to ensure the success of organizations. In organizations, knowing, understanding, and using the management skills as one of the necessities of life in the modern era is only possible under the shadow of knowledge management (Thomson and Prosak, 2000).

Darker (1913) has expressed that knowledge, in the world today's economy, is not a source similar and along with other sources such as labor, capital, and land, but is considered as the only nowadays' meaningful resource (Rading, 2004).

Managers of tomorrow should be habituated to the knowledge management; otherwise, they can not success in the field of management. Currently, nonexistence of a thought based on knowledge is one the most challenges of the country and, particularly, the Ministry of Agriculture Jihad. Nonexistence of a thought based on knowledge management is one the most challenges of the country and, particularly, the forest, rangeland, and watershed organization. Considering that most modern organizations are unaware of the knowledge management quality which is the key element of their organizations progress, this study is aimed to review the status of knowledge management and organize the

organizational knowledge and introduce the role of knowledge management in organizations so that nonexistence of thought based on knowledge would cause no challenge for the organizations. Lack of knowledge management in organizations has problems including: nonexistence of innovation and introduction signs, lack of prioritization and use of knowledge branches, nonexistence of foreign knowledge and new knowledge learners, lack of information systems management, hiding and politicizing information, gaps in the organization caused by the experts disconnection, hoarding the knowledge rather than increasing it, forgetting the important and fundamental issues of the organization, limited use of available sciences, lack of documentation regarding the experiences obtained and inappropriate motivating systems for knowledge sharing and development, and many other such problems implicating the importance and role of knowledge management application by organizations' managers. Knowledge management is one of the important roles of management in management civilization. Like other roles of management, this role contains several steps, and various activities justify this role. Knowledge management includes identifying knowledge management objectives, knowledge identification, knowledge acquisition, knowledge development, knowledge emission and distribution, knowledge

using, knowledge preservation, and knowledge assessment. (Aidemark, 2009).

The main purpose of this study is evaluating the role of knowledge management of the country's forest, rangeland, and watershed organization's manager's performance. The objectives are: reviewing and prioritizing different aspects of knowledge management (Identifying knowledge, Acquiring knowledge Developing knowledge, Collective knowledge, Using knowledge, Preserving knowledge and Measuring Knowledge) in the country's forest, rangeland and watershed organization, organization's managers performance, the role of knowledge management `s various aspects and their components in the organization's managers performance, factors affecting the knowledge management of the organization's managers, barriers and problems of the organization in imparting knowledge management, personal characteristics of the organization's managers.

## 2. Material and Methods

The methodology of this research was descriptive, and it was carried out as a correlation. The instrument that was used for data collection was a questionnaire. The statistical population including 300 managers of the Forest, Rangeland and Watershed of country; based on census, questionnaire was sent to all provinces' natural resources organizations of which 239 questionnaires were received from 22 provinces and, subsequently, analyzed. Dependent variable of this study is the managers' performance and the independent variables are: identifying knowledge (considering the organizations needs of knowledge in the organizational objectives, attention rates to new knowledge culture in the organization, organizations' staff interact inside and outside of the organization), Acquiring knowledge (using the knowledge of university and research centers, research units of the organization's role in making new knowledge, level of organization's efforts to form working groups), Using knowledge (the rate of existing knowledge about how to identify tasks or activities, the rate of existing knowledge regarding the principles and theories governing the observable facts of organization, the rate of existing knowledge about the customer satisfaction), Collective knowledge (using internet, intranet and network for knowledge transfer, knowledge transfer rate of organizations as guidelines and so on, the rate of knowledge transfer through in-service training), Developing knowledge (activities of forest and rangeland research institute in favor of the specialized needs, organization's level of attention to savant human resource development, the rate of institutionalize the employee's experience in

the organization) and Preserving knowledge (the rate of documentation in the organization, level of organization databases and computer networks usage in knowledge preservation and success of the organization in report making and documentation).

Content and face validity were established by a panel of experts consisting of natural resources extension, researchers, experts and managers of the country's forest, rangeland, and watershed organization. Minor wording and structuring of the instrument were made based on the recommendation of the panel of experts.

A pilot study was conducted with 30 managers. Computed Cronbach's Alpha score was 84%, which indicated that the questionnaire was highly reliable.

## 3. Results

In this study, the average age of the respondents was 43 / 5 years; most of them were undergraduate and postgraduate and few had diploma and PhD degree. Their average years of service were 20 / 5 years and their management experience average was about 11 years. Rate of their familiarity with knowledge management was at intermediate level to low showing the weakness of the forest, rangeland and watershed organization's managers in understanding the knowledge management. Evaluations showed that 34% of respondents have only heard the name of this type of management. About 30.5 % have become familiar through media, 18.5 % have read article about that, 5.5 % have participated in knowledge management related conferences and 7 % have used knowledge management in the organization.

In regarding the prioritizing dimensions of knowledge management, as table 1 shows identifying knowledge is in highest priority. The other dimensions including using knowledge, collective knowledge, acquiring knowledge, preserving knowledge and developing knowledge, in respectively.

Table 1: prioritizing dimensions of knowledge management

Dimensions	Mean	SD
identifying knowledge	2.89	0.83
using knowledge	2.86	0.89
collective knowledge	2.65	0.90
acquiring knowledge	2.31	0.90
preserving knowledge	2.12	0.89
developing knowledge	2.02	0.86

Results of correlation coefficient among variables showed that there is a positive and significant relationship at a 5% level between

identifying knowledge, using knowledge, collective knowledge, developing knowledge, acquiring

knowledge and preserving knowledge variables with manager's performance (Table 2).

Table 2: Correlation between dimensions of knowledge management with manager's performance

Dimensions	r	p
identifying knowledge	0.393*	0.00
using knowledge	0.422*	0.00
collective knowledge	0.455*	0.00
acquiring knowledge	0.398*	0.00
preserving knowledge	0.462*	0.00
developing knowledge	0.437*	0.00

\*\*p<0.05.

Results of multiple stepwise regression showed that using knowledge, preserving knowledge and acquiring knowledge variables have a positive effect on the forest, rangeland and watershed managers' performance while the mentioned variables have determined 31.5 % of the dependent variable's variance (Table 3).

Table 3: Multiple Regression Analysis

Variables	B	Beta	Sig	Sig.
Constant	9.50 1.01	-	0.000	
using knowledge (X1)		0.251	0.000	
preserving knowledge (X2)	1.24	0.272	0.031	
acquiring knowledge (X3)	0.77	0.188		

R<sup>2</sup>= 0.315

According to the following table, multiple regression linear equations are:

$$Y=9.50+ 1.01(X1) +1.24(X2) +0.77(X3)$$

$$Y=0.251 (X1) +0.272(X2) +0.188(X3)$$

#### 4. Discussions

Research results conducted by Roozdar (2002) and Khansari (2005) showed that there is a positive and significant relationship between the knowledge management and managers performance. Studies conducted by Shah Gholiyan (2005) showed that components of knowledge management change the organization's knowledge level. Zolfaghari (2006) resulted that the implementation of knowledge management increases the effectiveness of teaching and learning and improves the performance of the organization's employees. The study results of Safai (2005) showed that applying knowledge management principles using appropriate ICT have an effect on the managers learning and, compared with traditional methods, increase their performance. Research results of Holozky (2002) at the University of Oregon showed that people's believe in the organization, giving latitude, encouraging people to innovation, and risk taking of the organizations' superior managers would result in people's more efforts to create business ,development ,and knowledge sharing in the organization. Results of Mary Woods (2003) study entitled "The relationship between leadership

based on knowledge management and organizational culture" indicates that a successful organizations have an organizational culture that supports the creativity, employees' abilities, innovation, and record making. Organizations that have a headship based on a well-built knowledge management and organizational culture are more successful in knowledge gaining, information, and analysis of complex situations; these are confirmed in the present study.

1 - results showed that the acquiring knowledge variables had a positive effect on the performance of organization's managers and, on the other hand, acquiring knowledge components in the organization were at a low level so it is suggested that the organization uses universities, research centers and institutions to achieve the knowledge needed , highlights the role of research units of organizations in making new knowledge in the organization, and pays more attention to form working groups to consult and find new solutions for the current problems.

2 – In according to results. preserving knowledge variable had a positive effect on the performance of organization's managers and, on the

other hand, preserving knowledge components in the organization were at a low level so documenting the organization's previous failures and successes, organization's more effort in report making and documentation, and organization's more usage of databases and computer networks for preserving more knowledge are suggested.

3 - Using knowledge variable had a positive effect on the performance of organization's managers. Therefore, increasing the level of the organization's knowledge related to the organization's specific tasks or activities performance ways, the level of the organization's knowledge related to the theories and principles governing the organization's procedures, and the rate of knowledge usage in the organization to identify and tout customers is suggested.

4 - The organization's managers familiarity with knowledge management was weak and only 7 percent said that they applied knowledge management in organizations showing the weakness of managers concerning the understanding and applying the knowledge management which should be strengthened. Therefore, it is suggested that in-service training classes for managers (Junior and senior managers) on the subject of the knowledge management should be considered.

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**Genotoxic Effects Of Organophosphate Pesticide Phorate In Some Exotic Fishes Of Kashmir**, Farooq Ahmad Ganai<sup>\*1</sup>, Maraj-ud-din Malik<sup>2</sup> and Zeenat Nisar<sup>2</sup><sup>1</sup> Limnology and Fisheries Laboratory, Centre of research for Development, University of Kashmir-19006, India.<sup>2</sup> P.G. Department of Zoology, University of Kashmir, 190006, India**\*Corresponding author:** Farooq Ahmad Ganai, Email: [farooqmd84@gmail.com](mailto:farooqmd84@gmail.com).

**ABSTRACT:** Genotoxic effects of phorate, a commonly used pesticide were evaluated in two exotic sub-species of fish, *Cyprinus carpio* L. (family *Cyprinidae*) namely *Cyprinus carpio specularis* and *Cyprinus carpio communis* using micronucleus test. Genotoxicity of said pesticide was confirmed by incidence of micronucleus in peripheral erythrocytes using three sub-lethal concentrations viz 0.2ppm, 0.4ppm and 0.6ppm of phorate after 24, 48 and 72 hours. All the three concentrations were able to induce micronuclei formation in erythrocytes of both fish species. However, after 48h and 72h, a statistically significant increase was found in the frequency of micronuclei in peripheral erythrocytes of both fish species. The percentage of single micronuclei in *Cyprinus carpio specularis* ( $0.03 \pm 0.01$  in control) increased to  $1.15 \pm 0.32$  from low to high concentrations after 24h and  $2.74 \pm 0.52$  in longer exposures. In *Cyprinus carpio communis* somewhat similar results were observed with increase in percentage of single micronuclei ( $0.03 \pm 0.01$  in control) to  $1.30 \pm 0.23$  at 24h from low to high concentration and this percentage continued to increase by  $2.08 \pm 0.31$  and  $2.91 \pm 0.39$  after 48 and 72 h respectively (Mann-Whitney U test;  $p < 0.05$ ).

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**Key words:** Micronucleus; *Cyprinus*; Phorate; Genotoxicity; Pesticide.

**INTRODUCTION**

Phorate is an organophosphate pesticide effective against a wide array of insects, mites and some nematodes. It is used on a variety of field crops but 80% of its use is on corn, potatoes and cotton. Other crops include beans, peanuts, sugar beets, sorghum, wheat and soyabean. In Kashmir phorate is used on a variety of crops especially it is used to control woolly apple aphid.

Phorate is very highly toxic to birds and other wild life. It has been responsible for numerous incidents of mortality in birds and fish. Fish provide a relevant model for the evaluation of aquatic genotoxicity *in situ*, as well as the action of polluted effluents, sediments or toxic compounds (Hayashi *et al.*, 1998). The advantage of fish as model organism include the fact that fish respond in a manner similar to mammalian test species to chemicals that induce peroxisome proliferation in hepatocytes and oxidative damage in hepatocytes. The advantages of using fish as model organisms include the ease with which the fish, especially aquarium species, can be held in laboratory and exposed to toxic chemicals. Since fish often respond to toxicants in a manner similar to higher vertebrates, they can be used to screen for chemicals that have the potential to cause teratogenic and carcinogenic effects in humans.

With the last decade, the use of fish as appropriate models for genetic monitoring of toxic chemicals in aquatic environments has become popular (Pacheco and Santos, 1998).

A variety of *in vitro* and *in vivo* assays with fish are being used as a model system for toxicological, biochemical and developmental studies (Powers, 1989). At the cellular level the micronucleus test on various fish tissues is among the most wide spread assessments of genotoxicity in water (Al-Sabti K and Hardig J, 1990). Various investigations using fish as sentile for screening the clastogenic effects of xenobiotics indicate that these fish represent good experimental models for genotoxicity studies (Matsumoto and Colus, 2000; Porto *et al.*, 2005, Pantaleao *et al.*, 2006).

The aim of the present study is to investigate the genotoxic effects of a known organophosphate pesticide, phorate on two sub-species of *Cyprinus carpio* fish, *Cyprinus carpio communis* (scale carp) and *Cyprinus carpio specularis* (mirror carp), phenotypically differentiable according to the pattern of scales, when exposed to different concentrations of the said organophosphate pesticide, using micronucleus test.

Micronucleus test can be performed on different cell types like lymphocytes,

erythrocytes, fibroblasts, and exfoliated epithelial cells, without extra *in vitro* cultivation step. The micronucleus assay is generally accepted as equivalent to the cytogenetic assay in responsiveness to chemical mutagens. As scoring is less consuming, the assay is preferred for routine screening purposes. Another advantage of the micronucleus assay is that micronucleated erythrocytes persist in the peripheral blood for a relatively longer time, therefore allowing the study of chronic exposure to potential mutagens (Choy *et al.*, 1985).

Micronucleus assay originally developed with mammalian species, has been extensively used to test for genotoxic activity of chemicals (Heddle *et al.*, 1983). The micronucleus test in fish has a potential for detecting clastogenic activity. Various studies have shown that the peripheral erythrocytes of fish have a high incidence of micronuclei after exposure to different pollutants under field and laboratory conditions.

## MATERIALS AND METHODS

### Experimental animals

Two sub-species of *Cyprinus carpio* L. (family *Cyprinidae*) namely *Cyprinus carpio specularis* and *Cyprinus carpio communis* were used as experimental animals as they are available throughout the year in Kashmir. Adult specimens of both sub-species were collected from Dal-lake and were identified on the basis of their scales. Fish were acclimatized for 45 days at 28°C prior to trials (Anitha *et al.*, 2000)<sup>10</sup>. Specimens were kept in polypropylene troughs each with 7-8 individuals/50 L of water. Water was kept O<sub>2</sub> saturated by aeration. The troughs were cleaned daily and the water as well as the pesticide was renewed to keep the concentration constant throughout the test period of 24, 48, 72 h. Control fish were kept in dechlorinated tap water without any treatment. Fish were fed commercial fish feed daily at least one hour prior to the replacement of water. Only healthy, active fish starved for 24hr were used for the experiment and they were allowed no food during treatment procedures.

### Insecticide chemical and dose selection

The commercial grade of phorate was obtained from G.M.Shah pesticides, Srinagar; manufactured from Cyanamid, India Ltd. (Bombay). On the basis of literature data (LC<sub>50</sub> values for phorate), three sub-lethal concentrations (0.2ppm, 0.4ppm and 0.6ppm) of phorate were then selected for the experiment.

### Experimental design

Group I (Control): One group of fish from each sub-species was selected as control, kept in chlorinated water without any treatment. They were fed once daily commercial fish feed.

Group II: The fish sample from two sub-species was subdivided into three sub groups each, based on the dose selection of the pesticide. All subgroups had equal number of fishes (five fish/group/duration) maintained in 50litre/polypropylene troughs. After treatment with pesticide, the frequencies of micronuclei in all experimental sub-groups were examined at three durations (24, 48 and 72h) and at each concentration

### Cytogenetic studies using micronucleus test

The method of Schmid (1975) was used. The fish were injected with 0.1 ml of 0.025% colchicine and sacrificed two hours later with a slight blow on the head region. Chemical treated and control fish were cut in the caudal. From the freshly collected blood, smears were made on grease free slides. After fixation using methanol as fixative, slides were stained with Mayer's hematoxylin, rinsed in Scott's tap water substitute, followed by another staining in eosin (Pascoe and Gatehouse, 1986). After completion of this staining process, the slides were then washed in 30%, 50%, 70% and 90% alcohol, cleaned in xylene and mounted using D.P.X. The slides were then examined using a simple light microscope. For each concentration and duration, five fish specimens were used and from each fish, six slides were studied and 1200 cells were scored under 600x magnification.

### STATISTICAL ANALYSIS

Statistical analysis of data to verify the significant difference in the incidence of micronuclei between treated and control groups at 0.05 and 0.01 level of significance was performed using non-parametric criteria, Mann-Whitney U test to analyze the frequency of micronuclei.

### RESULTS

The genotoxicity of phorate in *Cyprinus carpio specularis* and *Cyprinus carpio communis* was confirmed by incidence of micronucleus in peripheral erythrocytes after 24, 48 and 72 hours. Three sub-lethal concentrations of phorate, 0.2 ppm, 0.4 ppm and 0.6 ppm were used, and it was observed that all these concentrations were able to induce micronucleus formation in erythrocytes of both the fish species. No increased incidence of

micronucleated erythrocytes of *Cyprinus carpio specularis* and *Cyprinus carpio communis* was reported with sub lethal concentration of 0.2 ppm after 24-hour intervals. However, after 48h and 72h, a statistically significant increase was found in the frequency of micronuclei in peripheral erythrocytes of both fish species. The percentage of single micronuclei in *Cyprinus carpio specularis* ( $0.03 \pm 0.01$  of control) increased to  $1.15 \pm 0.32$  from low to high concentrations after 24 h and continued to increase by  $1.78 \pm 0.30$  and  $2.74 \pm 0.52$  in longer exposures table 1 and table 2).

In *Cyprinus carpio communis* somewhat similar results were observed with increase in percentage of single micronuclei ( $0.03 \pm 0.01$  control) to  $1.30 \pm 0.23$  at 24 h from low to high

concentration and this percentage continued to increase by  $2.08 \pm 0.31$  and  $2.91 \pm 0.39$  after 48 and 72 h respectively.

Statistical analysis showed significant difference in the frequency of incidence of micronuclei in the erythrocytes of control and frequency of micronuclei in the erythrocytes of phorate treated groups of *Cyprinus carpio specularis* and *Cyprinus carpio communis* respectively (Mann-Whitney *U* test;  $P < 0.05$ ). Both dose and time dependent increase in the micronuclei frequency was observed in treated fish species and a peak value detected at higher concentrations after 72h of phorate injection, clearly showed a higher incidence of micronucleated peripheral erythrocytes.

**Table 1:** Micronucleus frequencies (%) in peripheral blood erythrocytes of *Cyprinus carpio specularis* exposed to different concentrations of phorate

Treatment	Concentration	MN frequencies (%)		
		24 h	48 h	72 h
		Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
Control	-	$0.03 \pm 0.01$	$0.05 \pm 0.01$	$0.05 \pm 0.01$
Phorate	0.2 ppm	$0.06 \pm 0.03$	$0.09 \pm 0.03^*$	$0.23 \pm 0.03^*$
	0.4 ppm	$0.34 \pm 0.11^*$	$0.54 \pm 0.15^*$	$0.88 \pm 0.12^*$
	0.6 ppm	$1.15 \pm 0.32^*$	$1.78 \pm 0.30^*$	$2.74 \pm 0.52^*$

(Mann-Whitney *U* test) \*  $P < 0.05$

**Table 2:** Micronucleus frequencies (%) in peripheral blood erythrocytes of *Cyprinus carpio communis* exposed to different concentrations of phorate

Treatment	Concentration	MN frequencies (%)		
		24 h	48 h	72 h
		Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
Control	-	$0.03 \pm 0.01$	$0.04 \pm 0.01$	$0.05 \pm 0.01$
Phorate	0.2 ppm	$0.04 \pm 0.01$	$0.08 \pm 0.03^*$	$0.28 \pm 0.01^*$
	0.4 ppm	$0.39 \pm 0.085^*$	$0.67 \pm 0.06^*$	$1.05 \pm 0.26^*$
	0.6 ppm	$1.29 \pm 0.23^*$	$2.08 \pm 0.31^*$	$2.91 \pm 0.39^*$

(Mann-Whitney *U* test) \*  $P < 0.05$

## DISCUSSION

Organophosphate insecticides are ubiquitous environmental contaminants because of their wide applications in agriculture. It is known that in fishes organophosphate pesticides are neurotoxic and they inhibit acetylcholinesterase activity with subsequent disruption of nervous functions, thereby interfering with some of the vital physiological functions (Rao and Rao, 1983). Since organophosphate pesticides are finding

increasing use in recent years, this can result in acute and long term side effects, including sickness and death of people, useful animals, fish, birds and destruction of crops.

In the present study, positive genotoxic effects, measured as micronucleus frequency in erythrocytes from both fish species (*Cyprinus carpio specularis* and *Cyprinus carpio communis*) exposed to different doses of phorate were observed. The result of the present study revealed

a significant induction of micronuclei in peripheral erythrocytes ( $p < 0.01$  and  $p < 0.05$ ) of both fish species. The appearance of inter-specific differences observed in the present study could be attributed to the specificity of DNA repair, cell turnover time, physiological peculiarities, contaminant uptake or biotransformation in the fish species studied.

On the other hand age, sex, reproductive status, genetic constitution may affect micronucleus frequency in fish (Al-Sabti *et al.*, 1994). However, *Cyprinus carpio specularis* and *Cyprinus carpio communis* in the present study were selected from the same age groups. The exposure was performed in the laboratory under standard experimental conditions. Therefore, the inter-specific differences in micronuclei incidences should not be attributed to the intrinsic problems of the experimental system used.

In the present study a significant difference in the micronucleus incidence among treated and control groups was observed. The peak frequency of micronucleated erythrocytes was observed at 72h after exposure.

The length of cell cycle critical to micronuclei formation depends upon the time needed to replicate DNA and perform nuclear division. In man and mice the duration of the cell cycle has been well documented. There is, however, little information on the duration of the cell cycle in the tissues of teleost species since the cell cycle varies with temperature in poikilotherms (Al-Sabti and Metcalfe, 1995). The incubation times were chosen without the benefit of specific knowledge of the times required for the division of fish cells (Al-Sabti, 1994). A time dependent increase in the incidence of micronuclei in peripheral erythrocytes of *Cyprinus carpio specularis* and *Cyprinus carpio communis* was established and confirms other observations (Al-Sabti, 1986; Nepomuceno and Spano, 1995; Nepomuceno *et al.*, 1997; Gustavino *et al.*, 2001; Buschini *et al.*, 2004). Increased chromosome aberrations and micronuclei were observed in bone marrow cells of rats that received (Dhingra *et al.*, 1990). Phorate in the present study was also found to induce micronuclei in peripheral erythrocytes of fish. The carbohydrate metabolism was found to be adversely affected by phorate in the serum of fresh water fish *Clarius batrachus* (Jyothi and Narayan, 1999). Decreased total serum levels and plasma ChE activity was observed in beagle dogs treated with phorate (Piccirillo *et al.*, 1987).

The present study reveals that micronucleus assay has a great potential for detecting

clastogenic substances in aqueous media. However, additional experimental evidence is needed to evaluate these hypotheses. Also further studies on aquatic organisms exposed in-vivo as well as in-vitro to various chemicals is certainly needed to clarify the mechanism of micronucleus formation.

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## Role of Some Insects in Transmission Some Apple Orchard Diseases in Egypt

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**Abstract:** Insects are probably the most important agents for spreading certain pathogenic diseases. Honeybee, *Apis mellifera* and rose chafer beetle, *Epicometis (Tropinota) squalida* played an important role to disseminate plant pathogenic diseases. Isolation from diseased apple orchard trees (*Malus domestica*) at EL-Nobaria location, Behira Governorate, Egypt, resulted that, three bacterial genera i.e. *Erwinia amylovora*, *Pseudomonas syringae*, *P. cichurii* and *Planococcus* spp., in addition the fungus *Monilinia mali* were isolated and identified from infected apple samples. *Erwinia amylovora* and *P. syringae* were the most frequency than others which recorded 30%, followed by *M. mali* fungus which gives 20%. Both *P. cichurii* and *Planococcus* spp. were the less frequency and each occurred with 10%. Honeybee (*Apis mellifera*) and rose chafer (*E. squalida*) insects were more efficacy to borne and transfer *M. mali* fungus and *P. syringae* as externally than internally. Population of these pathogens and percentage of contaminated insects were more effective during February and March than April. *A. mellifera* was more efficacy than *E. squalida* to transmit bacterial pathogens compared with pathogenic fungus. Meanwhile, *E. squalida* was more efficacy than *A. mellifera* to transmit pathogenic fungus than bacteria. However, insects were the most efficacious to transfer all tested pathogens mechanically. *A. mellifera* was more effective than *E. squalida* to transmit all tested pathogens.

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**Keywords:** Apple diseases, *Erwinia amylovora*; *Pseudomonas syringae* bacteria; *Monilinia mali* fungus; *Apis mellifera*; *Epicometis squalida*; insects

### 1. Introduction

Apple (*Malus pumila*, Mill) is one of the most important fruit crops and the fruits are considered as one of the popular fruits in many countries in the world. Apple trees attack by several microorganisms i.e. fungi, bacteria, viruses ....etc. in many of the important pomes fruit producing countries, and causing sever disease in different developmental stages as well as causing economic losses. So, the total cultivated areas of apple orchard in Egypt. were decreased from 26777.42 hectares in season (2006) to 24558.48 hectares in season (2008). Also, the total production area was decreased from 24518.41 hectares in season (2005) to 23010.93 hectares in season (2008). On the other hand, the total productivity were reduced from 23.57 to 15.67 (Ton/hectare) from 2005 to 2008 seasons, respectively. The presence data were tabulated in Table (1)\*.

Generally: Vector-pathogen relationships are important factors of epidemiologies of many plant diseases. Insects can be vectors of many plant pathogens including bacteria, mycoplasmas, viruses and fungi. They spread diseases by two basic methods; first, they carry fungal spores around with them like a bee pollinating plants. These spores are

superficial and simply contaminate the insect. Other insects spread disease when they feed on an infected plant or weeds (Purcell and Almeida, 2005).

Table 1. The total cultivated area (hec.), total production area (hec.) and yield production (Ton/hec.) of apple orchards in Egypt during (2005-2008) seasons.

Season	Total cultivated area (hectare)	Total production area (hectare)	Yield production (Ton/hectare)
2005	26483.61	24518.41	23.57
2006	26777.42	24188.99	23.57
2007	24798.87	23262.24	23.99
2008	24558.48	23010.93	15.67

\*Calculated by the General Department of agricultural statistics Ministry of Agriculture 2009.

Loss: In 1995, considerable loss of apple and pear flowers in parts of Switzerland was caused by fire blight. A chemical treatment is not available, so it is recommended that honey bees - which are possible vectors of the bacteria [*Erwinia amylovora*]

- should not be moved from areas with fire blight to fruit growing areas without it. Many plant diseases in the field or in harvested plant produce become much more serious and damaging in the presence of specific or non-specific insect vectors that spread the pathogen to new hosts. Insect vectors directly or indirectly caused about 30-40% of the plants damage and losses (Agrios, 1997). Destructive bacterial fire blight disease caused by *Erwinia amylovora* was introduced by bringing honey bee hives from Samsun to Gokhoyuk State Farm in Amasya in 1988. Since then infection has destroyed orchards of pears and quinces year by year with an increasing rate. In 1997 the orchards of pomes fruits in all the districts of Amasya except Gumushackoy and Hamamozu were infected with disease. Despite the late contamination to Tokat, orchards of pomes fruit in the districts of Pazar, Turhal, Yesilyurt and Zile as well as Central district were infected by up to 14.42% with fire blight.

Causal organisms: Fire blight occurs in many of the important pomes fruit producing countries. Other names formerly used are twig blight, blossom blight, fruit blight and spur blight. The leaves, green shoots, fruits, mature branches, and roots are attacked. Symptoms first appear on the blossom, which wither and die. Under humid conditions the affected blossoms and fruit exude creamy yellow of the ooze. Insects are the major agents of transmission (fire blight) from canker to blossom and from blossom to blossom, the honeybee is capable of transmitting the pathogen from blossom to blossom, but this insect is not known to visit cankers. Fire blight caused by *Erwinia amylovora* and is undoubtedly the most devastating diseases affecting apple, pear and other rosaceous plants (Fahy & Persly, 1983; Jones & Aldwinckle, 1990; Thomson, 1992; Zwet & Beer, 1995 and Vanneste, 2000). Bacterial ooze on cankers is carried into open blossoms by rainfall and probably more commonly by flies, ants and honey-bees. Aphids and leafhoppers also transmit the pathogen to growing terminals and water-sprouts (Hayward and Waterston, 1965). When *E. amylovora*, is present in nectar in flowers, nectar-collecting honey bees may carry the bacteria back to their colony. When flowers are infected, honey bees can spread bacteria to other trees. The life cycles of *Erwinia amylovora* on apples, pears and other rosaceae and its insect vectors, particularly pollinating insects, are outlined. Transmission of *E. amylovora* by domestic bees is considered in more detail. *Erwinia amylovora*, the causal agent of pomes fruit fire blight, it is a minor problem on apples. Insects are considered to play an important role in the spread of the inoculum especially pollinating insects, as well as sucking, chewing and boring insects are

claimed to be active in infection, and even a certain level of specificity between some insects and their role disseminating the bacteria is supposed. Insects were formerly supposed to be the major cause of infection and infections may take place even without a wound on young tissues (shoots and leaves ) provided the level of moisture is high (Jean, 1997). The disease effects essentially the transportation of honey bee (*Apis mellifera*) colonies. Bees are recognized as very successful short-distance disseminators of bacteria in the spring time. They may also act as vectors of the disease over large distances, when bee colonies are moved from infected to clear areas in April, May and June.

Blossom blight caused by *Pseudomonas syringae* and attack several hosts (Fahy & Persly, 1983, Jones & Aldwinckle, 1990 and Zwet & Beer, 1995). Three pathovars of *Pseudomonas syringae* are involved in the blast, canker and fruit spot syndrome of pomes fruit. Two pathovars caused of *P. syringae* are occasionally involved in a blossom blast and canker disease. A third pathovar caused branch cankers, bud blight, dead buds and leaf spots. Pollination is a predisposing factor in blossom blast.

Monilia blast caused by *M. mali* is an important diseases of apple and pear of wild species of *Malus* (Jones and Aldwinckle, 1990). Newly opened flower are normally free of pathogens and remain if protected from insect visitation or rain splash (Johnson & Stockwell, 1998). A variety of sucking insects that feed on fruits can introduce the fungus *Nematospora corylii*, which causes yeast spot disease of bean, coffee, cotton, and a variety of other crops. The feeding of a sucking insect, the grape phylloxera, causes lesions on the roots of grapevines that are invaded by soil fungi that deteriorate the roots, (Granett et al., 2001). Insects are definitely involved in secondary spread and many reports and its of potential insects have been published (Zwet & Beer, 1995; Vanneste, 2000; Kluth et. al., 2002 and Sasuclark, et.al., 2008).

The aim of this work is to isolation and identification the causal agent of apple disease(s), to study the role of some insects to borne and transfer these pathogens which attack apple trees, as well as efficacy of these insects to borne and transfer the causal agent of apple disease(s).

## 2. Material and Methods

### 2.1. Samples of plants

Samples of infected apple tree were collected from EL-Nobaria location, Behira Governorate in Egypt during (October 2009- June 2010 period) by examining, flowers, blossoms, twigs, young shoots or branches leaves and young fruits on a suitable number of trees according to

(OEPP, 1990a). Visual inspection of apple orchards in spring will show up characteristic symptoms of the disease causing blight and necrosis of shoots, branches and trunks. A characteristic symptom is apple green discoloration, rapidly browning round dormant buds on young shoots can be observed,

affected tissues appearing brownish red. Symptoms on leaves (necrotic spots with chlorotic halo) are produced in wet conditions and are not very characteristic, though symptoms may be seen on fruits (Fig 1), (Jeans-Pierre, 1997).



Figure 1. Symptoms on apple trees orchard (Natural infection).

## 2.2. Isolation and identification of the causal organisms

Diseased samples of apple trees showing blight symptoms on flowers, leaves, blossoms, twigs, shoots and small fruits (Fig 2) which were collected from EL-Nobaria district, Behira Governorate in Egypt were cut into small pieces, surface sterilized using 2% sodium hypochlorite for 2 min, then washed several times with sterilized distilled water (SDW) and divided into two groups:

### First group

Sterilized pieces were placed (planted) on sterilized Petri dishes each contained 10 ml of PDA medium (Ronald, 1995) and incubated at  $25^{\circ}\text{C} \pm 2$  for 3-5 days for fungal isolation. After incubation period, all fungal colony were purified on PDA medium and identified based on morphological characteristics and the available of literatures according to (Gilman, 1957 and Barnett and Hunter, 1972).

### Second group

Sterilized pieces were soaked and suspended in SDW 30 minutes for bacterial isolate, streaked on general N. A. medium (nutrient agar) and incubated at  $28^{\circ}\text{C} \pm 2$  for 2-3 days. After incubation period, single colony of the presence bacteria were purified by re-streaking on N.A. medium, and then identified based on the morphological and physiological characteristics according to (Schaad, 1980; Fahy & Persly, 1983; Lelliott and Stead, 1987).



Figure 2. 1 = Healthy. 2 = Infected. A = Infected branch. B = Infected flowers. C = Infected fruits.

## 2.3. Samples of insects

*Apis mellifera* and *E. squalida* which spread in apple orchards (EL-Nobaria district, Behira Governorate) were collected during February, March, and April period as a vector and transmitted the causal agent of apple diseases which attacks apple orchards.

## 2.4. Isolation and identification of the microorganisms associated with *A. mellifera* and *E. squalida*

Samples of these insects were treated and divided as followed:

**First group** of insect(s) were surface sterilized using  $H_2O_2$  for 30 second, washed several times by (SWD), then dried carefully using sterilized filter paper and transferred into Petri dishes, each contained 9ml of PDA medium for fungal isolation (Dhingra & Sinclair, 1995).

**Second group** of insect were sterilized as mentioned, then suspended in (SWD) and streaking on King's B medium (K.B.) to isolate *Pseudomonas syringae* (Fahy and Persly, 1983) and Kado & Hes-Rett D3 medium for *Erwinia amylovora* (Kado and Hes-Rett, 1970).

**Third group** were applied as it is without sterilized. Six insects per plates and 10 plates were used as replicates per treatment. All dishes were incubated at  $28^\circ C \pm 2$  for 3 days.

Percentage of contaminated insects were calculated and recorded as:

$T.N.C.I / T.T.I \times 100$ .

Whereas: T.N.C.I = Total Number of Contaminated Insects (showing fungal or bacterial colony).

T.T.I = Total of Tested Insects.

**Fourth group:** Unsterilized insects were suspended (10 insects / 100ml.) in sterilized saline solution (0.85% sodium chloride), then was shaken at 3000 rpm. for 5 min and diluted by added 1ml. of this stock to 9 ml of SDW in sterilized tubes. Approximately  $1 \times 10^3$  dilutions were placed onto sterilized Petri dishes each contained selective media as mentioned previously. Four plates were used as replicates for each treatment. All plates were incubated at  $28^\circ C \pm 2$  for 3 days. Population density of pathogen(s) was calculated (conc.) as followed:

Population density =  $M.N.C / T.N.T.I \times 100$

Whereas: M.N.C = Mean Number of Colonies.

T.N.T.I = Total Number of Tested Insects (Abd EL-Ghafar, 1998).

## 2.5. Insect transmission

The role and efficacy of both, *A. mellifera* and *E. squalida* as a vector for transmitting the apple tree pathogens were studied as follow:

### 2.5.1. Inoculums preparation

*E. amylovora* was grown on yeast extract, peptone, and dextrose agar (YPDA) medium for 48 hr. at  $28^\circ C$ . Bacterial culture cells were suspended in sterile saline solution (0.85% sodium chloride) and adjusted to concentration of  $10^8$  colony forming unit (cfu / ml) according to standard curve based on absorbance at 720 nm using spectrophotometer. While *Monilia mali* fungus was grown on potato dextrose agar (PDA) medium for 15 days at  $26^\circ C \pm 2$ . Fungal spores were flooded and harvested in sterile saline solution then suspended and diluted adjusted to concentration of  $10^7$  spore / ml.

### 2.5.2. Insect treatments

Transmission of plant pathogens by tested insects were examined in two experiments:

#### 2.5.2.1. Spraying treatment( externally)

The inoculums of pathogens were used as spray on the tested insects i. e. *A. mellifera* and *E. squalida* at rate 10 ml. pathogen(s) / 10 insects, using atomizer.

#### 2.5.2.2. Feeding treatment (internally)

*E. squalida* beetles were feeding for 2 days on pieces of banana mixed with the inoculums of pathogen(s), while *A. mellifera* were feeding on nutrient solution (SDW+ glycerol + glucose, 100m +Zn 1g) mixed with the inoculum for the same period time. Inoculated insects were transferred to cage containing apple flowers. Two cages were used as replicates per treatment. Each cage contained four replicates and each replicate consisted of two clusters of flowers, where flower cluster contained 12 flowers. Inoculated insects were left for three days into the cage. Each pathogen was used as spray treatment (Stahl and Luepschen, 1977). Efficacy of insect was determined according to Percentage of infected flowers =  $T.N.I.F. / T.T.F \times 100$ .

Whereas: T.N.I.F = Total Number of Infected Flowers.

T.T.F = Total of Treated Flowers.

The data were statistically analyzed using the (F) test and the value of L.S.D (P=0.05) according to (Snedecor and Cochran, 1967).

## 3. Results

### 3.1. Isolation and identification the causal agent of diseased apple trees



Isolation from diseased samples of apple trees showing blight symptoms in blossoms, twigs, leaves and small fruits as fire blight and or cankers which were collected from EL-Nobaria location, Behira Governorate, Egypt resulted that 200 isolates belong to 40 isolates of fungi ( equal 20 % ) and 160 isolates of bacteria (equal 80 % ). All fungal isolates were identified as *Monilinia mali*. Bacterial isolates were identified and classified into two groups based on Gram stain. The first group which are rod shaped and Gram negative (G-), it may belong to *Erwinia* and

*Pseudomonas* genera. The second group which are Gram positive (G+) these isolates were identified as *Planococcus* genus. Data were tabulated in Fig (3). Data show that, *Monilinia mali* fungus was moderate frequency which gave 20 %. *Erwinia amylovora* and *Pseudomonas syringae* were the most frequency than other microorganisms, each recorded 30 %. Both *Planococcus* spp. and *Pseudomonad cichurii* were less frequency and each recorded 10 %.

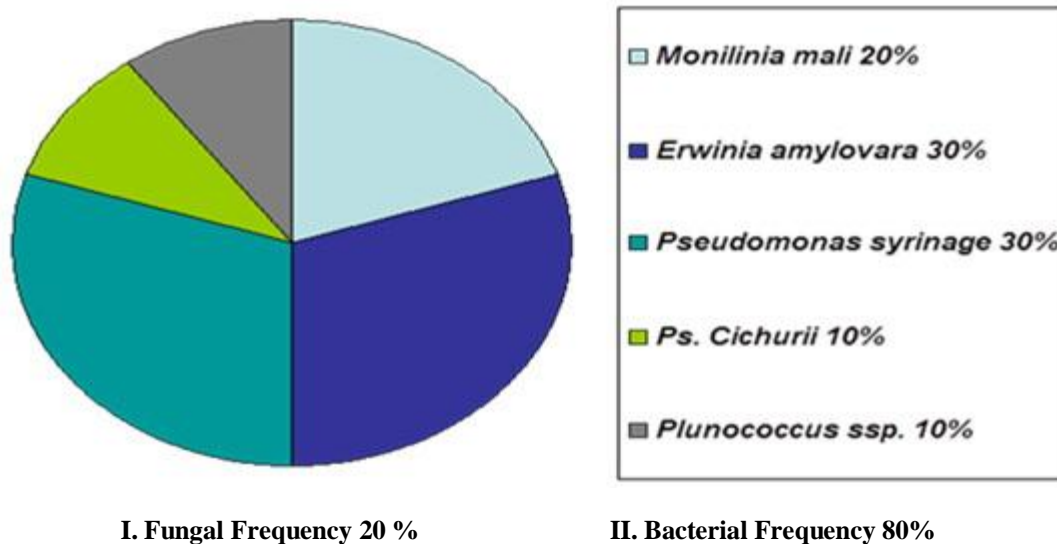


Figure 3. Frequency percent of fungal and bacterial isolates which isolated from diseased apple tree samples.

### 3.2. Efficacy of tested insects as vector of fungal and bacterial pathogens

*Apis mellifera* and *E. squalida* insects were more effective to borne all tested pathogens i.e. *Monilinia mali* fungus and either bacteria *Erwinia amylovora* and *Pseudomonas syringae* as externally borne than internally. Examined insects were the most efficacy to transmit the pathogens during February and March, where percentage of infested insects were tabulated in Table (2) as 17.3, 17.7, 27.2, 27.8 and 28.6, 28.9% for *A. mellifera* and 21.1, 21.9, 8.3, 8.9 and 9.0, 9.3% for *E. squalida*, respectively. The lowest percentages of tested insects as vectors of pathogenic diseases were recorded during April. The percentages of infested insects were 6.4, 10.7 and 11.3% for *A. mellifera* and 9.8, 3.2 and 3.7% for *E. squalida*, respectively. Meanwhile, *A. mellifera* was more effective than *E. squalida* to transmit pathogenic bacteria i.e. *E. amylovora* or *P. syringae* and the percentages of infested insects recorded as 10.7, 27.8 or 11.3, 28.9%

respectively. But *E. squalida* was more efficacy than *A. mellifera* to transmit *M. mali* fungus, where percentage of infested insects were 9.8, 21.9 and 6.4, 17.7% respectively. However, similarly results were obtained with population of pathogens transmitted by tested insects (Table3).

### 3.3. Efficacy of insects to transmit pathogens

The efficacy % of *A. mellifera* to transmit *M. mali*, *E. amylovora* and *P. syringae* externally were 45%, 54% and 56%, respectively. There were highly significant differences between tested insects in % of infested apple flowers externally. Efficacy of tested insects in transmitting pathogens whether externally (spraying treatment) or internally (feeding treatment) was tabulated in (Table 4). Both *A. mellifera* and *E. squalida* were more efficacy to transfer all tested pathogens i.e. *M. mali*, *E. amylovora* and *P. syringae* with spray treatment than feed treatment (externally than internally), where efficacy of insects were 29-56% for spray treatment



and 1-3% for feed treatment.. The efficacy % of *A. mellifera* to transmit *M. mali*, *E. amylovora* and *P. syringae* externally were 45%, 54% and 56%, respectively. There were highly significant differences between tested insects in % of infested apple flowers externally. *Apis mellifera* was more effective than *E. squalida* to transfer the pathogens, where efficacy of insect was 45-56% with spray treatment or 2-3% with feed treatment and was 29-32% with spray treatment or 1-2% with feed

treatment respectively. *Pseudomonas syringae* and *E. amylovora* were the most effective to transfer by examined insects, where efficacy of insects were 32-56 and 30-54% for spray treatment or 2-3 and 1-2% for feeding treatment, respectively. Meanwhile, *M. mali* was moderately effective to transfer by examined insects, where efficacy of insects were 29-45% for spray treatment or 1-2% for feeding treatment.

Table 2. Efficacy of tested insects as vector of fungal and bacterial pathogens which attack apple trees during (February – April 2010)period.

Insect	Period time	Pathogens contaminated insects (%)					
		<i>M. mali</i>		<i>E. amylovora</i>		<i>P. syringae</i>	
		Externally	Internally	Externally	Internally	Externally	Internally
<i>A. mellifera</i>	February	17.3	0.0	27.2	0.0	28.6	0.0
	March	17.7	0.0	27.8	0.0	28.9	0.0
	April	6.4	0.0	10.7	0.0	11.3	0.0
<i>E. squalida</i>	February	21.5	0.0	8.6	0.0	9.0	0.0
	March	21.9	0.0	8.9	0.0	9.3	0.0
	April	9.8	0.0	3.2	0.0	3.7	0.0
LSD 5%	Insects	3.7					
	Sample	2.4					
	Pathogen	3.0					
	Borne	1.8					
	Interaction	3.9					

Table 3. Mean numbers of spores or cells of pathogens counts internal or external of tested insects of apple orchard during (February – April 2010) period.

Insect	Period time	Mean numbers of spores or cells of pathogens					
		<i>M. mali</i> (10 <sup>7</sup> )		<i>E. amylovora</i> (10 <sup>8</sup> )		<i>P. syringae</i> (10 <sup>8</sup> )	
		Externally	Internally	Externally	Internally	Externally	Internally
<i>A. mellifera</i>	February	1.4	0.0	1.8	0.0	2.0	0.0
	March	1.5	0.0	1.9	0.0	2.1	0.0
	April	1.0	0.0	1.3	0.0	1.5	0.0
<i>E. squalida</i>	February	1.5	0.0	1.0	0.0	1.2	0.0
	March	1.7	0.0	1.2	0.0	1.4	0.0
	April	1.0	0.0	0.7	0.0	0.8	0.0
LSD 5%	Insects	3.7					
	Sample	2.4					
	Pathogen	3.0					
	Borne	1.8					
	Interaction	3.9					

Table 4. Efficacy of tested insects to transmit certain fungal and bacterial pathogens externally or internally, under artificial inoculation treatment

Pathogen	Insect	Externally		Internally	
		% Infected flowers of apple	% Efficacy of insect	% Infected flowers of apple	% Efficacy of insect
<i>M. mali</i>	<i>A. mellifera</i>	15.1	45	0.6	2
	<i>E. squalida</i>	9.8	29	0.9	1
	Check	33.7	100	33.7	100
<i>E. amylovora</i>	<i>A. mellifera</i>	18.3	54	0.7	2
	<i>E. squalida</i>	10.3	30	0.4	1
	Check	34.0	100	34.0	100
<i>P. syringae</i>	<i>A. mellifera</i>	19.0	56	0.9	3
	<i>E. squalida</i>	10.9	32	0.6	2
	Check	33.9	100	33.9	100
LSD 5%	Pathogen	3.4			
	Insect	2.6			
	Treatment	4.3			
	Interaction	5.5			

#### 4. Discussions

Many plant diseases in the field or in harvested plant produce become much more serious and damaging in the presence of specific or non-specific insect vectors that spread the pathogen to new hosts (Agrios, 1997). Isolation from diseased apple tree samples showing blight symptoms in blossoms, twigs, leaves and small fruits as fire blight and or cankers which were collected from EL-Nobaria location, Behira Governorate, Egypt yielded 200 isolates belong to 40 isolates of fungi ( equal 20 % ) and 160 isolates of bacteria ( equal 80 % ). These isolates were identified as *M. mali* fungus which was moderate frequency and gave 20 %. *E. amylovora* and *P. syringae* were the most frequency than other microorganisms, each recorded 30 %. Both *Plonococcus* spp. and *Pseudomonad cichurii* were less frequency and each recorded 10 %. Fire blight, blossom blight and twig blight, stem and branch canker a description is provided for *Erwinia amylovora* disease. Other records probably involve confusion with *Pseudomonas syringae* (Hayward & Waterston, 1965). *Erwinia amylovora*, the causal agent of pomes fruit fire blight, it is a minor problem on apples. Other names formerly used are twig blight, blossom blight, fruit blight and spur blight. The leaves, green shoots, fruits, mature branches, and roots are attacked (Ogawa and English, 1991). Also, they reported that, three pathovars of *Pseudomonas*

*syringae* are involved in the blast, canker and fruit spot syndrome of pomes fruit. Pollination is a predisposing factor in blossom blast.

Monilia blast caused by *M. mali* is an important diseases of apple and pear of wild species of *Malus* (Jones and Aldwinckle, 1990).

Meanwhile, *A. mellifera* was more effective than *E. squalida* to transmit pathogenic bacteria i.e. *E. amylovora* or *P. syringae*. While *E. squalida* was more efficacy than *A. mellifera* to transmit *M. mali* fungus. However, similarly results were obtained with population of pathogens previous on insects which previously mentioned. Bees and other pollinating insects may disseminate the epiphytic bacterium to other blossoms and leading to widespread distribution through the orchard (Stahle and Luepschen, 1977; Zwet and Keil, 1979 and Zwet, 1994).

*Apis mellifera* and *E. squalida* insects were more effective to borne all tested pathogens i.e. *Monilinia mali* fungus and either bacteria *Erwinia amylovora* and *Pseudomonas syringae* as externally borne than internally. The highest activity of both *A. mellifera* and *E. squalida* in pathogens transmitting was recorded during February and March and then decreased during April. Insects are considered to play an important role in the spread of inoculum especially pollinating insects, as well as sucking, chewing and boring insects are claimed to be active

in infection, and even a certain level of specificity between some insects and their role disseminating the bacteria is supposed (Jean, 1997). The disease effects essentially the transportation of honey bee (*A. mellifera*) colonies. Bees are recognized as very successful short-distance disseminators of bacteria in the spring time. They may also act as vectors of the disease over large distances, when bee colonies are moved from infected to clear areas in April, May and June (Sasuclark *et al* 2008). There was a direct relationship between insects with the blight pathogens and incidence of bacterial blight of pear (*E. amylovora* and *P. syringae*) and concentration of *P. syringae* cells was less than cells of *E. amylovora*. *Apis mellifera* was the main disseminator of the blight pathogens, but *Zeuzera pyrina* and *Musca domestica* were had a moderate effect in transmission and *Anacridium aegyptium* was less effective (Abd El-Ghafar, 1998, Hildebrand, *et. al.*, 2000 and Abo Al-Maatty, 2001).

*A. mellifera* and *E. squalida* were more efficacy to transmit all tested pathogens i.e. *M. mali*, *E. amylovora* and *P. syringae* externally (29-56%) than internally (1-3%). *A. mellifera* was more effective than *E. squalida* to transmit the pathogens, where efficacy of *A. mellifera* was 45-56% externally or 2-3% internally and was 29-32% externally or 1-2% internally, respectively. *Pseudomonas syringae* and *E. amylovora* were the most effective to transfer by examined insects, where efficacy of insects were 32-56 and 30-54% externally or 2-3 and 1-2% internally, respectively. Meanwhile, *M. mali* was moderately effective to transmit by examined insects, where efficacy of insects were 29-45% externally or 1-2% internally. Honey bees have sharp tarsal claws and stiff bristle could cause microscopic injuries, while foraging for nectar or pollen, thus allowing the pathogen entry into the tissues (Thomson, 1992, Zwet and Beer, 1995 and McLeod *et al.* 2005). Feeding behaviour of *E. squalida* destroy roses apple blossoms, especially (anther), which is part stamens pollen content, as well as, the feminization of pistil. Also, adults congregate in groups on the flower, causing injuries in parts of the flower and thus transmit pathogens to blossoms (Nel and Schotz 1990; Browne and Schttz 1999 and Abd El-Aziz *et al.*, 2006).

## 5. Conclusion

*A. mellifera* and *E. squalida* insects transmit all tested pathogens mechanically. *A. mellifera* was more efficacy than *E. squalida* to transmit bacterial pathogens compared with pathogenic fungus. Meanwhile, *E. squalida* was more efficacy than *A. mellifera* to transmit pathogenic fungus than bacteria.

*A. mellifera* was more effective than *E. squalida* to transmit all tested pathogens.

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## Moisture-Dependent Dielectric Properties of Pea and Black-Eyed Pea

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**Abstract:** In this paper, a cylindrical capacitor was used to measure the dielectric constant of seeds. By measuring the dielectric constant, the moisture content of grains may be predicted. Change in dielectric constant of pea and black eyed-pea was investigated as a function of moisture content. Results showed that the dielectric constant highly depended on moisture content at all frequencies. The best results were obtained at 1 MHz frequency for pea and black-eyed pea with  $R^2$  of 0.994 and 0.999 respectively. This frequency can be used to calibrate the instrument for measuring the moisture content of pea and black eyed-pea.

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**Keywords:** dielectric constant, Instrumentation, Moisture content, Seed.

### 1. Introduction

Moisture content is the most important physical property of seeds that affects other seed attributes. For example, the coefficient of friction, density and mechanical properties of agricultural products change when the moisture content varies. Also, the optimum stage of harvesting severely depends on the moisture content of seed. Various methods have been developed to estimate the moisture content of agricultural materials. A typical method is oven drying technique, which is a destructive and time-consuming method. Microwave spectroscopy is a suitable technique for determining the moisture content of agricultural goods (Gradinarsky et al., 2006; Kraszewski et al., 1997). The moisture content can also be determined by using neutron moisture gauges, which exploit the dependency of neutron parameters on the average hydrogen concentration (Nagy, 1968).

Infrared and laser light absorption spectroscopy are applied for measurement of the surface moisture content in various substances (Edwards et al., 2001), but these methods need expensive instrument. Capacitive technique is a simple, rapid and low cost method that can be used to determine the moisture content of seeds and grains. Because of these advantages, capacitive sensor is used in precision agriculture. Li et al. (2003) measured moisture content of cookies using dielectric spectroscopy. They used concentric sensor head that had been designed for localized measurements. It had three electrically separated sensing electrodes that were used as a fringing field sensor, when combined with a driving plate, as a parallel-plate sensor. They used 6 volt, 10 Hz to 10 kHz frequency sweep signal and a divider circuit to measure the capacitance of

sensor. They reported that at the higher frequencies the sensitivity was increased, so they selected 10 kHz to calibrate the system. They calibrated the system based on a linear model, where the functional dependence of capacitance on moisture content was determined. The system allowed for both online moisture content sensing and moisture distribution profile imaging.

Campbell et al. (2005) designed and developed a system based on capacitive sensor for monitoring bees passing through a tunnel that was able to distinguish between entering and exiting bees and provide information on the size and velocity of each bee. Jarimopas et al. (2005) designed and developed an electronic device with a cylindrical capacitive sensor to measure the volume of selected fruits and vegetables. Ragni et al. (2006) used a sine wave radio frequency oscillator with parallel plate capacitor sample probe to predict the quality of egg during storage period. They noted the suggested models enabled to classify samples of shell eggs. Afzal et al. (2010) estimated leaf moisture content by measuring the dielectric constant of leaves in five different types of crops. They carried out experiments on five field crops of maize, sorghum, capsular bean, white bean and sunflower. According to their results, type, amount of ions and the leaf thickness affected the capacitance and produced the error in this method. They reported that the coefficients of determination were higher at 100 kHz than at 1 MHz. They observed that the higher the leaf moisture, the more the data points were scattered around the best-fit line, although the scattering was more uniform at 1 MHz.

The objective of this study was to investigate the relationship between moisture content



and dielectric constant of seeds and develop a non-destructive and rapid measuring method by using the capacitive sensor for estimating pea and black eyed-pea moisture content.

## 2. Materials and Methods

### 2.1. Sample preparation

The required quantity of pea and black eyed-pea was provided and cleaned to prepare samples at five levels of moisture content. At each level, about 80 g of seeds was provided. The initial moisture content of seeds was determined by oven method (level 3). In order to reach the higher moisture level, to prohibit gemmating, the seeds samples were exposed to saturated air in an isolated box at 30 °C for 18 hours (level 4) and 36 hours (level 5), respectively. To reach the lower moisture content level, the oven method was used at 60°C for 24 hours (level 2) and 48 hours (level 1). After collection of samples, they were stored in a refrigerator at 4 °C for 72 hours.

### 2.2. Instrumentation

An instrument based on capacitive technique was designed and developed to measure the dielectric constant of seeds at various moisture contents (Figure 1). The instrument consists of a signal conditioning circuit, a 10-bit Microcontroller (ATMega 32) interfaced with a 16×2 LCD display and sinusoidal function generator (XR2206). Function generator produces an AC current with variable magnitude and frequency. The produced sine signal was fed to capacitive sensor and output signal from the sensor was sent to signal conditioning circuit. The final output voltage was measured by ADC unit of microcontroller and the capacitance and dielectric constant of sample was computed by microcontroller and results displayed on LCD. Specific software was developed by C – language for calculations.

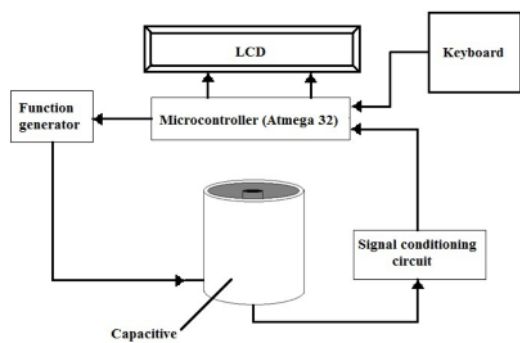


Figure 1. Block diagram of instrument for measuring the dielectric constant of seeds.

### 2.3. Cylindrical capacitive sensor

Figure 2 shows the capacitive sensor that was used in this research. The electrodes material was selected from aluminum. To avoid any occurrence of conduction, two polyethylene plates were used in construction of sensor. Each electrode was covered by a polyethylene layer with 1 mm thickness.

### 2.4. Dielectric Calculation

The capacitance of a cylindrical capacitor can be calculated by Eq.1.

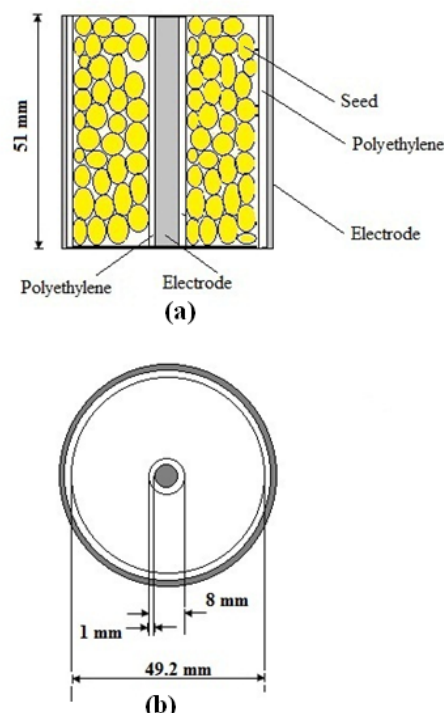


Figure 2. Cylindrical capacitive sensor filled with seed. (a) Section cut. (b) Top view.

$$C = \frac{2\pi \epsilon_r \epsilon_0 h}{\ln\left(\frac{b}{a}\right)} \quad (1)$$

where;  $\epsilon_r$  is the dielectric constant of material,  $\epsilon_0$  is the permittivity of air ( $8.85 \times 10^{-12}$  F/m),  $h$  is the height of material,  $b$  and  $a$  are the radius of the outer and inner concentric cylinders.

It can be seen that each side of the polyethylene intermediary in Figure. 2 is in contact with the electrodes and seeds, so polyethylene layer became the series capacitance to the measuring system. The equivalent circuit diagram is shown in Figure. 3. In the diagram,  $C_{P1}$  and  $C_{P2}$  are the polyethylene capacitance,  $C_m$  is the measured capacitance, and  $C_{eq}$  is the equivalent capacitance of

the sample ( $C_s$ ) and air gap ( $C_{air}$ ) that exists among seeds in the container, so seeds and air make a parallel capacitors. To measure the dielectric constant of polyethylene, a rectangular parallel plate capacitor with polyethylene dielectric material was constructed and its dielectric constant was calculated.

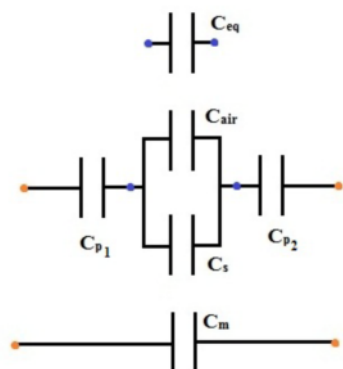


Figure 3. The equivalent circuit of capacitive sensor.

$C_{eq}$  can be calculated by Eq. 2.

$$C_{eq} = \frac{1}{\frac{1}{C_m} + \frac{1}{C_{p1}} + \frac{1}{C_{p2}}} \quad (2)$$

The ratio of air gap volume to total volume of filled capacitor is defined as porosity ( $P$ ) of seed, so the height of air gap in capacitor ( $h_{air}$ ) is  $P \times h$  and the height of sample ( $h_s$ ) is  $(1-P) \times h$ . therefore:

$$C_{air} = \frac{2\pi \epsilon_0 P h}{\ln\left(\frac{b}{a}\right)} \quad (3)$$

$$C_s = C_{eq} - C_{air} \quad (4)$$

$$\epsilon_s = \frac{C_s \ln\left(\frac{b}{a}\right)}{2\pi \epsilon_0 (1-P)h} \quad (5)$$

## 2.5. Experiments

Dielectric measurement of seeds was carried out at 5 levels of moisture content at 1 kHz, 10 kHz, 100 kHz, 500 kHz and 1 MHz frequencies. After electrical experiments, the moisture content of each sample was measured using oven method. The moisture content ( $\%MC_{db}$ ) was calculated on dry basis by Eq.6. Average porosity of pea and black eyed-pea are 0.435 and 0.41 respectively (Ayman et al., 2010; Unal et al., 2006) All measurements were performed in a laboratory with an average room temperature of 25 °C.

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$$\%MC_{db} = \frac{w_w}{w_d} \times 100 = \frac{(w_i - w_d)}{w_d} \times 100 \quad (6)$$

where;  $w_i$  is the initial weight of sample,  $w_w$  is the weight of water in sample and  $w_d$  is the weight of dried sample.

Microsoft Excel 2007 was used to analyze data and determine the regression models between the studied attributes.

## 3. Results and Discussion

The measured moisture contents ( $\%db$ ) of pea and black-eyed pea specimens are presented in Table 1. Acceptable amplitude of variation is observed in moisture content of pea and black-eyed pea.

Table 1. Moisture content of prepared samples ( $\%db$ ).

Level	Pea	Black- eyed pea
1	4.34	5.3
2	6.15	7.78
3	9.73	12.11
4	17.17	19.68
5	19.35	20

The relation between  $\epsilon_s$  and moisture content ( $\%MC_{db}$ ) of pea is presented in Figure 4. A high correlation is observed between  $\epsilon_s$  and  $\%MC_{db}$  at each frequency. At higher frequencies, the curves are smoother. The best equation that fitted to data is found as a quadratic function.

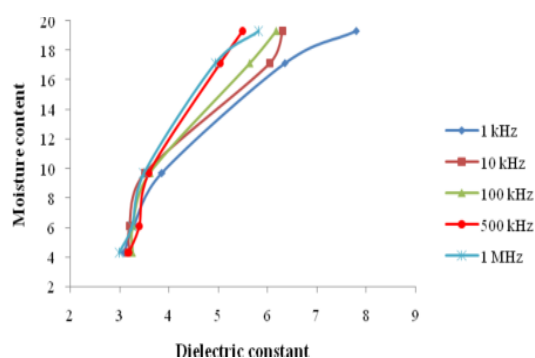


Figure 4. Change in moisture content versus dielectric constant of pea.

Results of regression analysis are presented in Table 2. The lowest value of coefficient of determination found at 10 kHz ( $R^2 = 0.963$ ) which is an acceptable value. It means that quadratic function can fit into relation of  $\epsilon_s$  -  $\%MC_{db}$  as well.

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Table 2. Results of regression analysis for prediction of pea moisture content.

Frequency	Equation	R <sup>2</sup>
1 kHz	$\%MC_{db} = -0.607 \varepsilon_s^2 + 9.646 \varepsilon_s - 19.11$	0.994
10 kHz	$\%MC_{db} = -1.823 \varepsilon_s^2 + 21.34 \varepsilon_s - 43.83$	0.963
100 kHz	$\%MC_{db} = -1.325 \varepsilon_s^2 + 16.98 \varepsilon_s - 35.56$	0.973
500 kHz	$\%MC_{db} = -2.095 \varepsilon_s^2 + 24.44 \varepsilon_s - 52.10$	0.988
1 MHz	$\%MC_{db} = -1.653 \varepsilon_s^2 + 19.82 \varepsilon_s - 40.15$	0.994

Figure 5 shows the relation between  $\varepsilon_s$  and moisture content ( $\%MC_{db}$ ) of black-eyed pea. A high correlation is observed between  $\varepsilon_s$  and  $\%MC_{db}$  at each frequency. The same results were obtained for black-eyed pea. Guo et al. (2007) reported a decrease in dielectric constant of apple when frequency of input signal had been increased. The best equation that fits to data is found as a quadratic function. Similarity between Figure 4 and Figure 5 reveals the fact that correlation between  $\%MC_{db}$  and  $\varepsilon_s$  approximately is the same for black-eyed pea and pea.

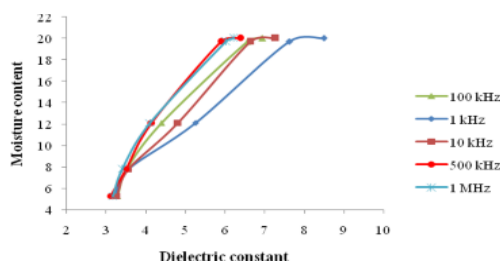


Figure 5. Change in moisture content versus dielectric constant of black-eyed pea.

Table 3. Results of regression analysis for prediction of black-eyed pea moisture content.

Frequency	Equation	R <sup>2</sup>
1 kHz	$\%MC_{db} = -0.210 \varepsilon_s^2 + 4.65 \varepsilon_s - 7.35$	0.989
10 kHz	$\%MC_{db} = -0.998 \varepsilon_s^2 + 14.1 \varepsilon_s - 29.16$	0.998
100 kHz	$\%MC_{db} = -0.797 \varepsilon_s^2 + 12.0 \varepsilon_s - 25.46$	0.996
500 kHz	$\%MC_{db} = -0.998 \varepsilon_s^2 + 14.1 \varepsilon_s - 29.16$	0.998
1 MHz	$\%MC_{db} = -1.084 \varepsilon_s^2 + 14.9 \varepsilon_s - 30.77$	0.999

Results of regression analysis are presented in Table 3. The lowest value of R<sup>2</sup> was found at 500 kHz as 0.988. Although this value was the lowest one, from stand view of statistic, it is an indication of high correlation between  $\varepsilon_s$  and  $\%MC$ . A homographic behavior exists between moisture content and dielectric constant of seed that is substantiated following:

The ratio of water weight to dry material weight of sample is defined as moisture content ( $\%MC_{db}$ ) of seed, therefore:

$$w_w = \rho_w A h_w \quad (7)$$

where;  $\rho_w$  is the density of water,  $A$  is the base of cylindrical capacitor and  $h_w$  is the height of water in capacitor.

$$w_d = \rho_d A h_d \quad (8)$$

where;  $\rho_d$  is the density of dry material,  $A$  is the base of cylindrical capacitor and  $h_d$  is the height of sample's water in capacitor.

Substituting Eq. 7 and Eq. 8 into E.q 6 and setting  $\rho_w = 1$ , the following equation is obtained:

$$MC_{db} = \frac{\rho_w h_w}{\rho_d h_d} = \frac{h_w}{\rho_d h_d} \quad (9)$$

The sample is composed of dry material and water, so these materials perform a pair of parallel capacitors, therefore:

$$\varepsilon_s = \varepsilon_d h_d + \varepsilon_w h_w \quad (10)$$

where;  $\varepsilon_s$  is the dielectric constant of whole sample,  $\varepsilon_d$  is the dielectric constant of dry material and  $\varepsilon_w$  is the dielectric constant of water.

$$h_s = h_w + h_d \quad (11)$$

where;  $h_s$  is the height of sample in capacitor.

From Eq. 10 and Eq. 11, it is obtained that:

$$\varepsilon_s = \varepsilon_d (h_s - h_w) + \varepsilon_w h_w \quad (12)$$

$$\varepsilon_s = \varepsilon_d h_s - \varepsilon_d h_w + \varepsilon_w h_w \quad (13)$$

$$\varepsilon_s = \varepsilon_d h_s + (\varepsilon_w - \varepsilon_d) h_w \quad (14)$$

From Eq. 9:

$$MC_{db} = \frac{h_w}{\rho_d h_d} = \frac{h_w}{\rho_d (h_s - h_w)} \quad (15)$$

By simplifying of Eq. 15,  $h_w$  is obtained as a function of  $MC_{db}$ .

$$h_w = \frac{MC_{db} \cdot h_s \cdot \rho_d}{1 + MC_{db} \cdot \rho_d} \quad (16)$$

By Eq. 13 and Eq.16 the following equation is obtained:

$$\varepsilon_s = \varepsilon_d h_s + \frac{MC_{db} (\varepsilon_w - \varepsilon_d) h_s \rho_d}{1 + MC_{db} \cdot \rho_d} \quad (17)$$

By substituting of  $a = \varepsilon_d h_s$  and  $b = (\varepsilon_w - \varepsilon_d) h_s \rho_d$ , following homographic equation is obtained:

$$\varepsilon_s = a + \frac{b \cdot MC_{db}}{1 + \rho_d \cdot MC_{db}} \quad (18)$$

Eq. 18 is a homographic function, therefore our claim is substantiated.

MS-Excel software does not have a homographic trend line option, but quadratic trend line can fit into homographic function reliably, because the shape of these functions is similar. For example if the equation  $y = 0.25 + \frac{4x}{1 + 0.6x}$  is figured in Excel software and a quadratic trend line is fitted to it, the  $R^2$  is obtained as 0.99 as shown in Figure 6.

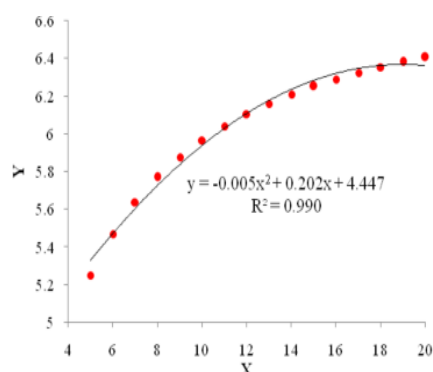


Figure 6. Curve of a typical homographic function and quadratic trend line.

#### 4. Conclusion

To investigate change in dielectric constant of pea and black eyed- pea as a function of moisture content, an instrument was designed and developed. Relation between dielectric constant and moisture content was extracted and quadratic trend line was fitted to data. The results were obtained as expected. Dielectric constant changed as homographic function when moisture content varied. By this method, the moisture content of seeds and grains can be predicted reliably.

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## An LMI Approach to Design Dynamic Output Feedback Control for Stochastic Hybrid Systems

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**Abstract:** This paper deals with the stabilization of a class of uncertain stochastic hybrid systems. The uncertainties are norm bounded type. Under the complete access to the system mode a dynamic output feedback controller that makes the closed-loop dynamics of this class of systems regular, impulse-free and stochastically stable is designed. The state space matrices of this controller are the solution of some linear matrix inequalities (LMIs).

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**Keywords:** Stochastic systems; Stabilization; Dynamic output feedback control; LMI.

### 1. Introduction

In practice, there exist some industrial systems that cannot be represented by the class of linear time-invariant model, since the behavior of the dynamics of these systems is random with some special features. As an example of such systems, we mention those with abrupt changes, breakdowns of components, etc. Such class of dynamical systems can be adequately described by the class of stochastic hybrid systems which is the subject of this paper.

This class of systems referred to also as Markovian jump systems, Systems with random structures, have attracted a lot of researchers, attention and many problems have been tackled and solved. Among these problems, we quote those of stability, stabilizability,  $H_\infty$  control problem and filtering problem. For more details on what has been done on this class of systems, we refer the reader to the recent books by Arnold (2008), Boukas (2007) and Boukas (2005) and the references therein where different results on stochastic hybrid systems with or without time-delay have been developed. These two books present a good literature review on the subject up to 2004. Particularly, the stabilization problem has attracted many researchers from control community and many results have been reported in the literature.

For the singular system which also can be used to represent a variety of practical systems like electrical circuits, mechanical systems, robotics, etc. (see Boukas (2001) for some examples), the developed results in the literature for regular systems cannot be used and new techniques need to be developed. Some attempts have been made (i) to check the stability and (ii) to stabilize the class of deterministic singular systems. For more details on these, we refer the reader to Boukas (2002) for stability and to Arnold (2008), Boukas (2007) and Boukas (2003) for the stability and the stabilization, and the references therein. Note also that other

problems have been tackled among them we address in this paper  $H_\infty$  control problem (see Dai (1989), de Farias (2000) and the references therein for more details). For the singular stochastic hybrid systems, Boukas and his coauthors have attempted to tackle some problems for this class of systems when the dynamics have time-delay. For more details, we refer the reader to Ishihara (2002), Kats (2002) where LMI results on the design of stabilizing state feedback controllers have been developed. To the best of our knowledge, the stabilization of continuous-time singular stochastic hybrid systems using a dynamic output feedback controller has never been tackled and our objective in this paper is to study this problem. This technique of stabilization is, even in the deterministic case, a hard problem in general that cannot easily be formulated as an LMI problem. Our goal in this paper consists of designing a dynamic output feedback controller that makes the closed-loop dynamics of the class of systems we are studying, regular, impulse-free and stochastically stable. Under the assumption of the complete access to the system mode, a stabilizing dynamic output feedback controller is designed. The gains of such controller are determined by solving a set of LMIs. We have to note that to get the LMI setting, equality restrictive condition is used. The rest of the paper is organized as follows. In Section 2, the problem we are considering is stated and some definitions are given. Section 3 gives the main results of the paper that determines the static output feedback controller which assures the closed-loop dynamics of the stochastic hybrid system is regular, impulse-free and stochastically stable.

### 2. General problem statement

Let us consider a dynamical singular system defined in a fundamental probability space  $(\Omega, \Phi, P)$



and assume that its dynamics is described by the following differential system:

$$\begin{cases} \tilde{E}\dot{x}(t) = A(r_t, t)x(t) + B_1(r_t, t)w(t) + B_2(r_t, t)u(t) \\ z(t) = C_1(r_t)x(t) + D_{11}(r_t)w(t) + D_{12}(r_t)u(t) \\ y(t) = C_2(r_t)x(t) + D_{21}(r_t)w(t) \\ x(0) = x_0 \end{cases} \quad (1)$$

where  $x(t) \in \mathfrak{R}^n$  is the state vector,  $x_0 \in \mathfrak{R}^n$  is the initial state,  $u(t) \in \mathfrak{R}^n$  is the control input,  $y(t) \in \mathfrak{R}^n, \{r_t, t \geq 0\}$  is the continuous-time Markov process taking values in a finite space  $\varphi = \{1, 2, \dots, N\}$  and describes the evolution of the mode at time  $t$ ,  $E$  is a known singular matrix with  $\text{rank}(E) = n_E < n$ ,  $A(r_t, t) \in \mathfrak{R}^{n \times n}$  and  $B(r_t, t) \in \mathfrak{R}^{n \times n}$  are matrices with the following forms for every  $i \in \varphi$ :

$$\begin{aligned} A(i, t) &= A(i) + D_A(i)F_A(i, t)E_A(i), \\ B_2(i, t) &= B_2(i) + D_B(i)F_B(i, t)E_B(i) \end{aligned}$$

where  $A(i) \in \mathfrak{R}^{n \times n}$ ,  $B(i) \in \mathfrak{R}^{n \times n}$ ,  $C(i) \in \mathfrak{R}^{n \times n}$ ,  $D_A(i)$ ,  $E_A(i)$ ,  $D_B(i)$ ,  $E_B(i)$  are real known matrices with appropriate dimensions, and  $F_A(i, t)$  and  $F_B(i, t)$  are unknown real matrices that satisfy the following:

$$F_A^T(i, t)F_A(i, t) \leq I, F_B^T(i, t)F_B(i, t) \leq I \quad (2)$$

The Markov process  $\{r_t, t \geq 0\}$  beside taking values in the finite set  $\varphi$ , represents the switching between the different modes and its dynamics is described by the following probability transitions:

$$\begin{aligned} P[r_{t+h} = j | r_t = i] \\ = \begin{cases} \lambda_{ij}h + o(h) & \text{when } r_t \text{ jumps from } i \text{ to } j \\ 1 + \lambda_{ii}h + o(h) & \text{otherwise} \end{cases} \quad (3) \end{aligned}$$

where  $\lambda_{ij}$  is the transition rate from mode  $i$  to mode

$$j \text{ with } \lambda_{ij} \geq 0 \text{ when } i \neq j \text{ and } \lambda_{ii} = - \sum_{j=1, j \neq i}^N \lambda_{ij}$$

and  $o(h)$  is such that  $\lim_{h \rightarrow 0} \frac{o(h)}{h} = 0$ .

Throughout this paper, we assume that the system state  $x(t)$  is not accessible for feedback while the system mode  $r_t$  is.

**Remark 2.1.** Notice that when  $E$  is not singular, system (1) can be transformed to the class of Markov jump linear systems and the results developed in the literature can be used either to check

the stochastic stability, or to design the state feedback or the output feedback controllers that stochastically stabilize this class of systems. For more details on this matter we refer the reader to Arnold (2008), Boukas (2007) and the references therein.

**Definition 2.1.** Boukas (2001).

i. System (1) is said to be regular if the characteristic polynomial,  $\det(s\tilde{E} - A(i))$  is not identically zero for each mode  $i \in \varphi$ .

ii. System (1) is said to be impulse-free, i.e.  $\deg(\det(s\tilde{E} - A(i))) = \text{rank}(\tilde{E})$  for each mode  $i \in \varphi$ .

In the literature we can find different definitions for stochastic stability. Among them we quote the moment stability, the stability in probability and almost sure stability. For simplicity, we denote  $x(t, x_0, r_0)$ , as  $x(t)$  in the sequel, the solution of system (1) when the initial conditions are, respectively,  $x_0$  and  $r_0$ , the concept of stochastic stability, stochastic stabilizability and their robustness we will use in this paper are given by the following definitions (see Arnold (2008), Boukas (2007) or Boukas (2005)).

**Definition 2.2.** System (1) with  $u(t) \equiv 0$  is said to be:

1. Stochastically stable if there exists a constant  $M(x_0, r_0) > 0$  such that the following holds for any pair of initial conditions  $(x_0, r_0)$ :

$$E \left[ \int_0^\infty x^T(t)x(t)dt \mid x_0, r_0 \right] \leq M(x_0, r_0); \quad (4)$$

2. robust stochastically stable if it is stochastically stable for all admissible uncertainties.

**Definition 2.3.** System (1) is said to be:

1. Stochastically stabilizable if there exists a controller  $\tilde{K}(s)$  that

$$U(s) = \tilde{K}(s)Y(s) \quad (5)$$

$$\text{Where } \tilde{K}(s) = \begin{bmatrix} A_k & B_k \\ C_k & D_k \end{bmatrix} \text{ and } \begin{cases} \dot{x}_k = A_k x_k + B_k y \\ u = C_k x_k + D_k y \end{cases}$$

such that the closed loop system is stochastically stable.

2. Robust stochastically stabilizable if there exists a control of the form (5) such that the closed-loop system is stochastically stable for all admissible uncertainties.

The aim of this paper is to (i) develop LMI-based conditions for system (1) with  $u(t) \equiv 0$  to check if a given system is regular, impulse-free and stochastically stable; and (ii) design a dynamic output feedback controller of the form (5) that makes the closed-loop dynamics of the class of systems under study regular, impulse-free and stochastically stable.

Before closing this section, let us give some Lemmas that we will use in the rest of the paper.

**Lemma 2.1** (Boukas (2007)). Let  $H, F$  and  $G$  be real matrices of appropriate dimensions, then, for any scalar  $\varepsilon > 0$  and a matrix  $F$  satisfying  $F^T F \leq I$ , we have

$$HFG + G^T F^T H^T \leq \varepsilon HH^T + \varepsilon^{-1} G^T G \quad (6)$$

**Lemma 2.2** Arnold (2008), Boukas (2007).

The linear matrix inequality  $\begin{bmatrix} H & S^T \\ S & R \end{bmatrix} > 0$  is

equivalent to  $R > 0, H - S^T R^{-1} S > 0$ , where  $H = H^T, R = R^T$  and  $S$  is a matrix with appropriate dimension.

**Lemma 2.3** Arnold (2008), Boukas (2007).

For any matrix  $u$ , and  $v \in \mathbb{R}^{n \times n}$  with  $v > 0$ , we have  $uv^{-1}u^T \geq u + u^T - v$ .

**Lemma 2.4** (Boukas (2007)) System (1) is regular, impulse-free and stochastically stable if there exists a set of nonsingular matrices  $X = (X(1), \dots, X(N))$ , such that the following coupled LMIs hold for every  $i \in \varphi$ :

$$\begin{cases} \tilde{E}^T X(i) = X^T(i) \tilde{E} \geq 0 \\ X^T(i) A(i) + A^T(i) X(i) + \sum_{j=1}^N \lambda_{ij} \tilde{E}^T X(j) < 0 \end{cases} \quad (7)$$

**Lemma 2.5** consider matrices  $P, Q$  and symmetric matrix  $H$ , the  $N_Q$  and  $N_P$  matrices with full rank have the below specification:

$\text{Im}(N_P) = \text{Ker } P, \text{Im}(N_Q) = \text{Ker } Q$ , where  $\text{Ker}(\cdot)$  is null space of the matrix and the  $\text{Im}(\cdot)$  is the rang of the matrix. Then there exists a matrix  $J$  such that:

$$H + P^T J^T Q + Q^T J P < 0 \quad \text{if and only if} \quad N_P^T H N_P < 0, N_Q^T H N_Q < 0.$$

### 3. Main results

Before developing the design procedure for the dynamic output feedback controller, let us assume that  $u(t) = 0$ , for  $t \geq 0$  and study the stochastic stability of the nominal system (1). Our concern is to establish LMI conditions to check if a given dynamical system of this class is regular, impulse-free and stochastically stable. Lemma (2.4) states the desired results on stochastic stability of such class of systems.

Let us now concentrate on the design of the dynamic output feedback controller of form (5). Plugging the controller expression in the dynamical

system (1) gives  $E \dot{x}_{cl} = A_{cl} x_{cl} + B_{cl} w$  with

$$\begin{aligned} x_{cl} &= \begin{bmatrix} x \\ x_{cl} \end{bmatrix}, E = \begin{bmatrix} \tilde{E} & 0 \\ 0 & I \end{bmatrix} \\ A_{cl} &= \begin{bmatrix} A(i) + B_2(i) D_k C_2(i) & B_2(i) C_k \\ B_k C_2(i) & A_k \end{bmatrix}, \\ B_{cl} &= \begin{bmatrix} B_1(i) + B_2(i) D_k D_{21}(i) \\ B_k D_{21}(i) \end{bmatrix}, \\ C_{cl} &= [C_1(i) + D_{12}(i) D_k C_2(i) \quad D_{12}(i) C_k] \\ D_{cl} &= D_{11}(i) + D_{12}(i) D_k D_{21}(i) \end{aligned}$$

The closed loop state space matrices can be written based on  $\tilde{K}$  as:

$$\begin{aligned} A_{cl} &= \bar{A} + \underline{B} \tilde{K} \underline{C} \\ B_{cl} &= \bar{B} + \underline{B} \tilde{K} \underline{D}_{21} \\ C_{cl} &= \bar{C} + \underline{D}_{12} \tilde{K} \underline{C} \\ D_{cl} &= D_{11} + \underline{D}_{12} \tilde{K} \underline{D}_{21} \end{aligned} \quad (8)$$

$$\text{where } \bar{A}(i) = \begin{bmatrix} A(i) & 0 \\ 0 & 0 \end{bmatrix}, \underline{B}(i) = \begin{bmatrix} 0 & B_2(i) \\ I & 0 \end{bmatrix},$$

$$\underline{C}(i) = \begin{bmatrix} 0 & I \\ C_2(i) & 0 \end{bmatrix}, \quad \bar{C}(i) = [C_1(i) \quad 0],$$

$$\bar{B}(i) = \begin{bmatrix} B_1(i) \\ 0 \end{bmatrix}, \quad \underline{D}_{12}(i) = [0 \quad D_{12}(i)],$$

$$\underline{D}_{21}(i) = \begin{bmatrix} 0 \\ D_{21}(i) \end{bmatrix}, \text{ and the } 0, I \text{ are zero and}$$

identity matrices with appropriate dimensions. The objective is to obtain the state space form representation matrices of controller.

As seen in (5) the closed loop state space matrices are linear function of the controller matrix  $\tilde{K}$ . The Lemma 2.5 has basic role in our theoretical derivations.

- *The nominal stability criteria using LMI:*

The stability of the closed loop system is the most important issue in the controller design.

Based on Lemma 2.4, the closed-loop system is regular, impulse-free and stochastically stable if there exists a set of nonsingular matrices  $X = (X(1), \dots, X(N))$  such that the following holds for every  $i \in \varphi$ :

$$\begin{cases} E^T X(i) = X^T(i) E \geq 0 \\ X^T(i) A_{cl}(i) + A_{cl}^T(i) X(i) + \sum_{j=1}^N \lambda_{ij} E^T X(j) < 0 \end{cases} \quad (9)$$

Using the expression of  $A_{cl}(i)$ , the second matrix inequality in equation (9) will be:

$$X^T(i)(\bar{A}(i)+\underline{B}(i)\tilde{K}\underline{C}(i))+(\bar{A}(i)+\underline{B}(i)\tilde{K}\underline{C}(i))^T X(i) + \sum_{j=1}^N \lambda_{ij} E^T X(j) < 0$$

Now defining matrices  $P_{x_{cl}}$ ,  $Q$  and  $H_{x_{cl}}$  as:

$$\begin{aligned} Q(i) &= \underline{C}(i) \\ P_{x_{cl}}(i) &= \underline{B}^T(i)X(i) \\ H_{x_{cl}}(i) &= \end{aligned} \quad (10)$$

$$\bar{A}^T(i)X(i) + X^T(i)\bar{A}(i) + \sum_{j=1}^N \lambda_{ij} E^T X(j)$$

The equation (11) is rewritten as following:

$$H_{x_{cl}}(i) + Q^T(i)\tilde{K}^T P_{x_{cl}}(i) + P_{x_{cl}}^T(i)\tilde{K}Q(i) < 0 \quad (11)$$

According to Lemma 2.5, the inequality (11) is equivalent to:

$$N_{P_{x_{cl}}}^T(i)H_{x_{cl}}(i)N_{P_{x_{cl}}}(i) < 0 \quad (12.a)$$

$$N_Q^T(i)H_{x_{cl}}(i)N_Q(i) < 0 \quad (12.b)$$

The inequality (12.a) is not an LMI of  $X(i)$  because  $X(i)$  appears in both  $H_{x_{cl}}(i)$  and  $N_{P_{x_{cl}}}(i)$ .

Defining  $T_{x_{cl}}$  and  $P$  as

$$P(i) := \underline{B}^T(i) \quad (13)$$

$$\begin{aligned} T_{x_{cl}}(i) &:= (X^{-1})^T(i)\bar{A}^T(i) + \bar{A}(i)X^{-1}(i) \\ &+ \sum_{j=1}^N X^{-T}(i)\lambda_{ij}E^T X(j)X^{-1}(i) \end{aligned} \quad (14)$$

The inequality (12.a) converts to an LMI set.

**Theorem 3.1.** For  $X \geq 0$ , the inequality

$N_{P_{x_{cl}}}^T H_{x_{cl}} N_{P_{x_{cl}}} < 0$  is equivalent to:

$$N_P^T T_{x_{cl}} N_P < 0 \quad (15)$$

Proof: the matrices  $P_{x_{cl}}$  and  $P$  are related to each other as following:

$$P_{x_{cl}} = PS \quad (16)$$

$$S = X \quad (17)$$

therefore we have

$$N_{P_{x_{cl}}} = S^{-1}N_P \quad (18)$$

inserting  $N_{P_{x_{cl}}}$  from equation (18) in the inequality

$$N_{P_{x_{cl}}}^T H_{x_{cl}} N_{P_{x_{cl}}} < 0 \text{ we have}$$

$$N_P^T (S^{-1})^T H_{x_{cl}} S^{-1} N_P < 0 \quad (19)$$

According to definition of  $H_{x_{cl}}$  in equation (10) and  $T_{x_{cl}}$  in equation (14), the inequality (19) is equivalent to equation (15).

Now, referring to equation (12) Theorem 3.1, the sufficient condition to exist a stabilizing controller is obtained as:

$$N_P^T T_{x_{cl}} N_P < 0 \quad (20.a)$$

$$N_Q^T H_{x_{cl}} N_Q < 0 \quad (20.b)$$

the inequality (20.a) is an LMI of  $X^{-1}$  and inequality (20.b) is an LMI of  $X$ . Therefore, the inequalities set (20) is not an LMI of  $X$ . To overcome this difficulty, it is assumed that the matrices  $X$  and  $X^{-1}$  have a structure as following:

$$X(i) = \begin{bmatrix} X_1(i) & X_2(i) \\ X_2^T(i) & X_3(i) \end{bmatrix} \quad (21.a)$$

$$X^{-1}(i) = \begin{bmatrix} Y_1(i) & Y_2(i) \\ Y_2^T(i) & Y_3(i) \end{bmatrix} \quad (21.b)$$

where  $X$  is a symmetric positive definite with dimension of  $(n+n_k) \times (n+n_k)$  and the sub matrices  $X_1$  and  $Y_1$  are of  $n \times n$  dimension.  $n$  and  $n_k$  are open loop system ( $G(s)$ ) and the controller ( $K(s)$ ) dimension, respectively. The following Theorem shows how to express the inequalities (20) using  $X_1$  and  $Y_1$  in an LMI framework.

The following Theorem shows how to describe the equation (20) utilizing  $X_1(i)$  and  $Y_1(i)$ .

**Theorem 3.2:** the inequalities set

$$N_P^T(i)T_{x_{cl}}(i)N_P(i) < 0$$

$$N_Q^T(i)H_{x_{cl}}(i)N_Q(i) < 0$$

holds if and only if:

$$\begin{aligned} N_O^T(i)(A^T(i)X_1(i) + X_1(i)A(i) \\ + \sum \lambda_{ij} \tilde{E}X_1(i))N_O(i) < 0 \end{aligned}$$

$$\begin{aligned} N_C^T(A(i)Y_1(i) + Y_1^T(i)A^T(i) + \\ \sum_{j=1}^N \lambda_{ij} Y_1^T(i) \tilde{E}^T Y_1^{-1}(j)Y_1(i))N_C < 0 \end{aligned}$$

where  $N_C(i)$  and  $N_O(i)$  are full rank matrices such that:

$$\text{Im } N_O(i) = \ker C_2(i)$$

$$\text{Im } N_C(i) = \ker B_2^T$$

Proof: first, we show that  $N_P^T T_{x_{cl}} N_P < 0$  is equivalent to

$$\begin{aligned} N_C^T(A(i)Y_1(i) + Y_1^T(i)A^T(i) + \\ \sum_{j=1}^N \lambda_{ij} Y_1^T(i) \tilde{E}^T Y_1^{-1}(j)Y_1(i))N_C < 0 \end{aligned}$$

To do this, inserting  $\bar{A}$  from equation (8) and  $X^{-1}(i)$  from equation (21.b) in the equation (14) and inserting the matrix  $\underline{B}(i)$  from equation (8) in equation (13).

Now, to calculate  $N_P$ , we have

$$\left. \begin{array}{l} \text{Im } N_P = \ker P \\ \ker P = \{x \mid Px = 0\} \\ \text{Im } N_P = \{y \mid N_P z = y\} \end{array} \right\} \Rightarrow N_P z = x \Rightarrow PN_P z = Px = 0$$

For some  $z$  :  
 $PN_P z = 0$

Choosing  $PN_P = 0$  we obtain  $N_P = \ker P$ , we can derive  $\ker P$  as

$$\begin{bmatrix} 0 & I \\ B_2^T(i) & 0 \end{bmatrix} \begin{bmatrix} V_1(i) & V_2(i) \\ V_3(i) & V_4(i) \end{bmatrix} = 0$$

$$\text{So, } \begin{cases} V_3(i) = V_4(i) = 0 \\ B_2^T(i)V_1(i) = 0 \\ B_2^T(i)V_2(i) = 0 \end{cases} \quad \text{and}$$

$$\ker P(i) = \begin{bmatrix} V_1(i) & V_2(i) \\ 0 & 0 \end{bmatrix}. \text{ For simplicity, assume } V_2 = 0 \text{ then}$$

$$\ker P(i) = \begin{bmatrix} V_1(i) & 0 \\ 0 & 0 \end{bmatrix}; \quad B_2^T(i)V_1(i) = 0 \quad (23)$$

$$\text{Therefore, } N_P(i) = \begin{bmatrix} V_1(i) & 0 \\ 0 & 0 \end{bmatrix} \text{ where } V_1(i)$$

is a member of the null space of  $B_2^T(i)$ . Since the second row of the matrix  $N_P(i)$  is zero, the second row and column of the matrix  $T_{x_{cl}}$  has no effect on the condition  $N_P^T T_{x_{cl}} N_P < 0$ , and we can eliminate the both row and column. Hence, choosing  $N_C = V_1$ , the inequality  $N_P^T T_{x_{cl}} N_P < 0$  can be rewritten as

$$\begin{aligned} & N_C^T (A(i)Y_1(i) + Y_1^T(i)A^T(i) + Y_1^T(i)\tilde{E}X_1(j)Y_1(i) + \\ & + Y_2^T(i)X_2^T(j)Y_1(i) + Y_1^T(i)\tilde{E}X_2(j)Y_2^T(i) \\ & + Y_2^T(i)X_3(j)Y_2^T(i))N_C < 0 \end{aligned} \quad (24)$$

so, the equivalency of two inequalities is proved.

In the same way it can be shown that  $N_Q^T H_{x_{cl}} N_Q < 0$  and

$$\begin{aligned} & N_O^T(i)(A^T(i)X_1(i) + X_1^T(i)A(i) + \\ & \sum_{j=1}^N \lambda_{ij} \tilde{E}X_1(j))N_O(i) < 0 \end{aligned} \quad (25)$$

are equivalent.

Selecting  $X$  as  $X = \text{diag}(X_1, X_3)$ , we have  $X^{-1} = \text{diag}(Y_1, Y_3)$ , where  $X_1^{-1} = Y_1$ ,  $X_3^{-1} = Y_3$ . then the equations (24) is simplified to

$$(26)$$

$$\begin{aligned} & N_C^T (A(i)Y_1(i) + Y_1^T(i)A^T(i) + \\ & + Y_1^T(i)\tilde{E}Y_1^{-1}(j)Y_1(i))N_C < 0 \end{aligned} \quad (26)$$

Pre- and post multiplying  $E^T X(i) = X^T(i)E \geq 0$ , respectively, by  $X^{-T}(i)$  and  $X^{-1}(i)$ , one has  $X^{-T}(i)E^T = EX^{-1}(i) \geq 0$ .

Replacing  $E$  and  $X^{-1}(i)$  give

$$\begin{aligned} & Y_1^T(i)\tilde{E}^T = \tilde{E}Y_1(i) \geq 0 \\ & Y_3(i) \geq 0 \end{aligned}$$

Now, let us assume the existence of  $W(i) = W^T(i)$  such that  $Y_1^T(j)\tilde{E}^T < W(j)$  holds for every  $j \in \varphi$ . If we define  $\Gamma_i(Y_1)$  and  $\Pi_i(Y_1)$  as

$$\begin{aligned} & \Gamma_i(Y_1) := \\ & \begin{bmatrix} \sqrt{\lambda_{i1}}Y_1^T(i) & \dots & \sqrt{\lambda_{ii-1}}Y_1^T(i) & \sqrt{\lambda_{ii+1}}Y_1^T(i) & \dots & \sqrt{\lambda_{iN}}Y_1^T(i) \end{bmatrix} \\ & \Pi_i(Y_1) := \text{diag}[Y_1(1) + Y_1^T(1) - \tilde{W}(1), \dots, \\ & Y_1(i-1) + Y_1^T(i-1) - \tilde{W}(i-1), \end{aligned} \quad (27)$$

$$Y_1(i+1) + Y_1^T(i+1) - \tilde{W}(i+1), \dots,$$

$$Y_1(N) + Y_1^T(N) - \tilde{W}(N)]$$

and using Lemma 2.3, we obtain

$$\sum_{j=1}^N \lambda_{ij} Y_1^T(i) Y_1^{-1}(j) Y_1(i) \leq \quad (28)$$

$$\lambda_{ii} Y_1^T(i) + \Gamma_i(Y_1) \Pi_i^{-1}(Y_1) \Gamma_i^{-1}(Y_1)$$

and the following sufficient conditions:

$$W(j) > Y_1^T(j)\tilde{E} = \tilde{E}^T Y_1(j) \geq 0$$

$$\begin{bmatrix} J(i) & \Gamma_i(Y_1) \\ \Gamma_i^T(Y_1) & -\Pi_i(Y_1) \end{bmatrix} < 0 \quad (29)$$

with

$$\begin{aligned} & J(i) = N_C^T(i)\bar{A}(i)Y_1(i)N_C(i) + N_C^T(i)Y_1^T(i)\bar{A}^T(i)N_C(i) \\ & + \lambda_{ii} N_C^T(i)Y_1^T(i)N_C(i) \end{aligned}$$

The following Theorem summarizes the results of this development.

**Theorem 3.2.** If there exist sets of nonsingular matrices  $X_1 = (X_1(1), X_1(2), \dots, X_1(N))$  and  $Y_1 = (Y_1(1), Y_1(2), \dots, Y_1(N))$  and a set of symmetric and positive-definite matrices  $W = (W(1), \dots, W(N))$ , such that the following set of LMI s holds for each  $i \in \varphi$ :

$$\begin{cases} Y_1^T(i)\tilde{E}^T = \tilde{E}Y_1(i) \\ (25) \\ (29) \end{cases}$$

then system (1) is regular, impulse-free and stochastically stable and the state space matrices of the controller can be computed through

$$H_{x_{cl}}(i) + Q^T(i) \tilde{K}^T P_{x_{cl}}(i) + P_{x_{cl}}^T(i) \tilde{K} Q(i) < 0 \quad (30)$$

**Remark 3.1.** Notice that the conditions we developed are only sufficient and since the matrix  $X$  was assumed diagonal, the LMIs may be conservative. But we have to notice that without this assumption the solution cannot be put in the LMI setting.

## 7. Conclusion

This paper dealt with the class of singular stochastic hybrid systems. LMI results on stochastic stability and stochastic stabilizability are developed. Under the assumption that the state vector is not available for feedback a dynamic output feedback controller is designed to make the closed-loop dynamics of this class of systems regular, impulse-free and stochastically stable. The controller state space matrices are determined by solving a set of coupled LMIs for the nominal system.

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## Influence of Some Rootstocks on the Performance of Red Globe Grape Cultivar

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**Abstract:** This investigation was conducted for three successive seasons (2008, 2009 and 2010) in a private vineyard located at El-Khatatba, Menoufiya governorate; to study the growth, yield and fruit quality of Red Globe grape cultivar grafted onto some rootstocks; Dogridge, Salt creek, Freedom, Harmony, and Paulsen 1103 in addition to own-rooted vines. The chosen vines were five-year-old, grown in a sandy loam soil, spaced at 2 X 3 meters apart, irrigated by the drip irrigation system, cane-pruned and trellised by the Spanish Parron system. The results showed that all rootstocks especially Dogridge, Salt creek and Freedom were effective in increasing the yield and its components, ensuring the best physical properties of bunches, improving the physical and chemical characteristics of berries, achieving the best vegetative growth parameters (i.e. average shoot diameter, average shoot length, average number of leaves/ shoot, average leaf area, total leaf area/vine, coefficient of wood ripening and weight of prunings) and increasing leaf content of total chlorophyll and percentages of total nitrogen, phosphorus and potassium as well as cane content of total carbohydrates in comparison with the non grafted vines. The economical study indicated that Red Globe grapevines grafted on Dogridge, Salt creek, Freedom, Harmony, and Paulsen 1103 rootstocks gave the maximum net profit compared with the own-rooted vines.

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### 1. Introduction

Rootstocks have recently gained great importance in the only consistently effective and successful strategy in major viticultural countries worldwide (Troncoso, *et al*, 1999 and Omer, *et al*, 1999). The importance of rootstocks in viticulture is well documented, they are used not only as an effective means of controlling important biological pests such as phylloxera and nematodes, but they can also be used effectively to regulate nutrient exclusion, uptake of water in the vine (McCarthy *et al.*, 1997; Walker *et al.*, 2000 and Keller 2001). However, the choice of a certain rootstock is becoming increasingly difficult as a result of the availability of numerous new rootstocks (Loreti and Massai, 2006). In addition, Reynolds and Wordle (2001) outlined seven major criteria for rootstocks choice in the order of their importance as phylloxera resistance, nematode resistance, adaptability to high pH soils, saline soils, low pH soils, wet or poorly drained soils and drought. These effects take place in a more or less indirect manner and are consequences of the interactions between environmental factors and the physiology of the scion and rootstock cultivars employed.

Many investigations proved that rootstocks affect vine growth, yield, fruit quality through the interactions between the environmental factors and the physiology of scions and rootstock cultivars employed. In this respect, Hedberg (1980) found that yields of all grafted cultivars were much higher than those of own-

rooted vines, especially those grafted on Ramsey and Dogridge rootstocks. Fardossi *et al* (1995) found that shoot growth of "Gruner veltline" was slower on "5C" and "Fercal" but more rapid on "P1103", "725P" and "125AA". Ripening of grapes occurred earlier on "1103P", "G1" and Riparia Sirbu" than on other rootstocks. Bunch quality, bunch weight, berry size and soluble solids content were affected by rootstocks (Zhiyuan 2003). The level of mineral uptake differed according to the rootstocks (Grant & Matthews 1996, Ruhl 2000 and Kocsis & Lehoczy 2002).

Red Globe grapevines are characterized by having a considerably low vine vigour, which is not proportional to the yield (Gasser, 2006). The good production of yield of this cultivar faces some challenges; depression of vegetative growth, increasing the possibility of berry exposure to sunburn damage and irregular colouration of the berry, these defects are undoubtedly reflected on reducing bunch quality.

The main goal of this investigation was to study the influence of some grape rootstocks; Dogridge, Salt creek, Freedom, Harmony, and Paulsen 1103 on growth, yield and fruit quality of Red Globe grapevines.

### 2. Material and Methods

This investigation was conducted for three successive seasons (2008, 2009 and 2010) in a private vineyard located at El-Khatatba, Menoufiya governorate; to study some parameters of growth, yield

and fruit quality of Red Globe grapevines grafted on some rootstocks; Dogridge, Salt creek, Freedom, Harmony, and Paulsen 1103 in addition to own-rooted vines. These rootstocks were characterized according to (Schmid *et al.*, 1998; Sule, 1999; Walker *et al.*, 2002 and Ozden *et al.*, 2010) as follows:

- Dogridge (V. champini): very high vigor with good resistance to nematodes, moderate resistant to phylloxera and moderate drought tolerant.
- Salt creek (V. champini): very high vigor with quite resistance to nematodes, moderate resistant to phylloxera and moderate drought tolerant.
- Freedom (1613C x V. champini): moderate to high vigor, highly resistant to nematodes and phylloxera and moderate drought tolerant.
- Harmony (1613C x V. champini): moderate vigor, highly resistant to nematodes, moderate resistant to phylloxera and moderate drought tolerant.
- Paulsen 1103 (V. berlandieri x V. rupestris): moderate vigor, moderately resistant to nematodes, highly resistant to phylloxera and highly drought tolerant.

The chosen vines were five-year-old, grown in a sandy loam soil, spaced at 2 X 3 meters apart, irrigated by the drip irrigation system, cane-pruned and trellised by Spanish Parron system. The vines were pruned during the third week of January with bud load of (72 buds/vine). Each five vines acted as a replicate and each three replicates were used for each rootstock under study.

\*The following parameters were determined to evaluate the performance of different rootstocks:-

Representative random samples of six bunches/vine were harvested at maturity when TSS reached about 16-17% according to Tourky *et al.*, (1995). The following characteristics were measured:

#### 1. Yield and physical characteristics of bunches:

Yield/vine (kg) was determined as number of bunches/vine X average bunch weight (g). Also, average bunch weight (g), bunch length and width (cm) were determined.

#### 2. Physical characteristics of berries:

Average berry weight (g), average berry size (cm<sup>3</sup>) and average berry dimensions (length and diameter) (cm) were determined.

#### 3. Chemical characteristics of berries:

Total soluble solids in berry juice (T.S.S.) (%) were determined using a hand refractometer and total titratable acidity was expressed as tartaric acid (%) according to (A.O.A.C., 1985). Hence TSS /acid ratio and total anthocyanin of the berry skin (mg/100g fresh weight) according to Husia *et al.*, (1965) were calculated.

#### 4. Some characteristics of vegetative growth

At growth cessation, the following morphological and chemical determinations were carried out on 4 shoots / the considered vine:

- 1- Average shoot diameter (cm).
- 2- Average shoot length (cm).
- 3- Average number of leaves/shoot.
- 4- Average leaf area (cm<sup>2</sup>) of the apical 5<sup>th</sup> and 6<sup>th</sup> leaves using a CI-203- Laser Area-meter made by CID, Inc., Vancouver, USA.
- 5-Total leaf area/vine (m<sup>2</sup>) was determined by multiplying average number of leaves/shoot by average leaf area then by the number of shoots per vine.
- 6- Coefficient of wood ripening was calculated by dividing length of the ripened part of the shoot by the total length of the shoot according to Bouard (1966).
- 7- Weight of prunings (Kg) at the dormancy period (winter pruning) was determined.

#### 5. Chemical characteristics of vegetative growth

- 1- Leaf total chlorophyll content: it was measured by using nondestructive Minolta chlorophyll meter SPAD 502 (Wood *et al.*, 1992).
- 2- Leaf mineral content: Percentage of nitrogen was determined using the modified micro-Kjeldahl method according to Pregl (1945). Percentage of phosphorus was determined calorimetrically estimated according to Snell and Snell (1967). Percentage of potassium was determined photometrically estimated according to Jackson (1967).
- 3- Cane total carbohydrates content (%): it was determined according to Smith *et al.*, (1956).

#### Statistical analysis:

The complete randomized blocks design was adopted for the experiment. The statistical analysis of the present data was carried out according to the methods described by Snedecor & Cochran (1980). Averages were compared using the new LSD method at 5% level.

#### 3. Results and Discussion

##### 1. Yield and physical characteristics of bunches:

Data shown in Table (1) revealed that yield and its components varied significantly among all rootstocks. It can be observed that Red Globe grafted onto Dog Ridge, Salt creek and Freedom rootstocks were found to produce the highest yield, followed in a descending order by those grafted onto Harmony and Paulsen 1103 rootstocks which produced an intermediate yield, while own-rooted vines gave the lowest yield in the three seasons under study.

The highest number of bunches per vine was recorded on vine grafted onto Freedom rootstock followed in a descending order by own-rooted vines. On the contrary, the fewest number of bunches per vine was recorded on Dog Ridge and Salt creek rootstocks in the three seasons.

Average bunch weight differed significantly among the rootstocks. The greatest bunch weight was given by Dog Ridge, Salt creek and Freedom rootstocks, while the smallest bunch weight was recorded on own-rooted vines. The bunch weight was intermediate in Harmony and Paulsen 1103 rootstocks.

Table (1): Influence of some rootstocks on yield/vine and physical characteristics of bunches in Red Globe grapevines in 2008, 2009 and 2010 seasons

Characteristics Rootstocks	Yield/vine (kg)			Average number of bunches			Average bunch weight (g)			Average bunch length (cm)			Average bunch width (cm)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Dogridge	16.67	18.11	21.35	20.1	21.6	25.4	829.4	838.3	840.7	20.9	21.3	21.6	12.7	12.9	13.2
Salt creek	16.40	17.85	21.02	20.3	21.9	25.6	808.1	814.9	821.1	20.7	21.2	21.4	12.6	12.7	13.1
Freedom	16.31	17.84	20.73	21.5	23.5	26.8	758.8	759.1	773.4	20.6	20.9	21.3	12.4	12.5	12.9
Harmony	15.92	17.43	20.27	21.3	23.2	26.6	747.6	751.5	762.1	20.4	20.8	21.1	12.3	12.3	12.8
Paulsen 1103	15.45	16.91	19.69	21.0	22.8	26.3	735.8	741.7	748.7	20.3	20.8	20.9	12.1	12.2	12.6
Own-rooted vines	14.66	16.05	18.73	20.6	22.3	25.9	711.5	719.8	723.1	19.9	20.3	20.5	11.8	11.9	12.1

new L.S.D. at 0.05 = 0.71 0.64 0.93 0.2 0.3 0.2 78.3 81.4 75.8 0.4 0.5 0.4 0.3 0.5 0.4

As regards bunch dimensions, it is clear that bunch length and bunch width were found to vary significantly among all rootstocks, Red Globe grafted onto Dog Ridge, Salt creek and Freedom rootstocks recorded the highest values, followed in a descending order by those grafted onto Harmony and Paulsen 1103 rootstocks which recorded the intermediate values, while own-rooted vines gave the lowest values in all seasons of the investigation.

As previously mentioned the smallest numbers of bunches per vine given by vines grafted on Dog Ridge and Salt creek rootstocks as compared to own-rooted vines, agree with the findings of Sommer *et al.* (1993) who showed that Ramsey and Dog Ridge (*Vitis champinii*) rootstocks conveyed high shoot length and vine vigour to the scions grafted onto them, with a tendency to develop dense canopies. They consequently observed the lesser penetration of sunlight into the leaf canopy and even negligible penetration of sunlight to the location of auxiliary buds in the vines grafted onto vigorous rootstocks in comparison with own-rooted vines and those grafted

onto less vigorous rootstocks. This explains the reduced fruit bud differentiation in more vigorous and denser canopies compared to vines with reduced shoot length and less vigour, which allow more sunlight to reach the fruiting buds during the period of fruit bud differentiation, resulting in higher fruitfulness.

The effect of rootstock on scion yield has been well documented; most results showed that rootstock significantly affects scion yield. In this respect, Hedberg *et al.* (1986) recorded higher yields on all grafted cultivars than on own-rooted vines, especially on Ramsey and Dog Ridge rootstocks. Similarly, Ferree *et al.* (1996) reported an increased yield from grafted Cabernet Franc and White Riesling than from own-rooted vines. Also, Wunderer *et al.* (1999) mentioned that 'Gruener Veltliner' grape had a higher wood productivity when grafted on the three rootstocks tested ('SO4', 'K5BB' and '5C') than that of the own-rooted vines. In addition, Sommer *et al.* (2001) found that grafted sultana vines were always more fruitful than own-rooted vines.

## 2. Physical characteristics of berries:

As shown in (Table 2), it is obvious that all berry physical components i.e. berry weight, size, length and diameter were significantly affected by the kind of rootstock. Red Globe vines grafted onto Dog Ridge, Salt creek and Freedom rootstocks recorded the highest values, followed in a descending order by those grafted onto Harmony and Paulsen 1103 rootstocks which recorded intermediate values. On the contrary, own-rooted vines gave the lowest values in the three seasons.

The obtained results referring to the positive effect of rootstocks on the physical characteristics of berries are in agreement with those reported by Gaser (2007) and Satisha *et al.*, (2010) who found that bigger and heavier berries, as indicated by higher berry diameter and berry weight, were recorded on vines grafted onto Dog Ridge rootstocks as compared to own-rooted vines.

## 3. Chemical characteristics of berries:

It is interesting to note that, all berry chemical parameters, including total soluble solids, titratable acidity, TSS/acid ratio and anthocyanin content of berry skin were significantly affected by rootstocks (Table 3).

Red Globe grafted onto Freedom, Harmony and Paulsen 1103 rootstocks were found to record the highest percentages of TSS, TSS/acid ratio and

anthocyanin content of berry skin and the lowest percentages of acidity of the berry juice, followed in a descending order by own-rooted vines which recorded intermediate values, while Red Globe grafted onto Dog Ridge and Salt creek gave the lowest values of TSS, TSS/acid ratio and anthocyanin content of berry skin and the highest values of acidity in the three seasons under study.

The influence of rootstock on fruit composition has been studied by several workers; Ciriaco *et al.* (1984) recorded higher juice pH in Shiraz grafted onto Ramsey, Dog Ridge, Harmony, Schwarzmanner and 1613C than in own-rooted vines. Fruits had greater colour density and more anthocyanins. In addition, Ruhl *et al.* (1988) showed that own-rooted 'Riesling', 'Ruby Cabernet' and 'Shiraz' had low to medium juice pH while the own-rooted 'Chardonnay' had higher juice pH; rootstocks 'Harmony', 'Dog Ridge', 'Freedom' and 'Rupestris du Lot' generally caused a high juice pH, whereas '140R', '1202', '5A', 'SO4' and '101-14' had low pH. Kubota *et al.* (1993) grafted Fujimori grapes onto seven different rootstocks and found that the highest level of skin anthocyanin was observed in berries from vines grafted onto 3306 C. Similarly, grafted Shiraz recorded higher colour hue than own-rooted vines (Walker *et al.*, 2000).

Table (2): Influence of some rootstocks on physical characteristics of berries in Red Globe grapevines in 2008, 2009 and 2010 seasons

Characteristics Rootstocks	Average berry weight (g)			Average berry size (cm <sup>3</sup> )			Average berry length (cm)			Average berry diameter (cm)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Dogridge	9.16	9.35	9.51	8.93	9.09	9.23	2.93	2.97	2.98	2.79	2.81	2.84
Salt creek	8.92	9.08	9.29	8.67	8.81	8.99	2.90	2.93	2.95	2.78	2.80	2.83
Freedom	8.35	8.44	8.74	8.09	8.15	8.43	2.88	2.90	2.94	2.75	2.79	2.81
Harmony	8.22	8.35	8.61	7.95	8.04	8.28	2.85	2.88	2.90	2.73	2.74	2.78
Paulsen 1103	8.09	8.24	8.46	7.82	7.92	8.13	2.84	2.85	2.88	2.70	2.74	2.75
Own-rooted vines	7.81	7.98	8.14	7.53	7.64	7.80	2.76	2.78	2.81	2.62	2.64	2.67

new L.S.D. at 0.05 =                      0.91      0.97      0.86      0.95      0.98      0.91      0.06      0.08      0.07      0.05      0.06      0.05

Table (3): Influence of some rootstocks on chemical characteristics of berries in Red Globe grapevines in 2008, 2009 and 2010 seasons

Characteristics Rootstocks	TSS (%)			Acidity (%)			TSS/acid ratio			Total anthocyanin (mg/100g F.W.)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Dogridge	15.6	15.9	15.8	0.57	0.55	0.54	27.4	28.9	29.3	23.7	25.1	25.5
Salt creek	15.7	15.9	16.0	0.55	0.54	0.52	28.5	29.4	30.8	24.7	25.7	26.9
Freedom	16.4	16.7	16.7	0.52	0.49	0.46	31.5	34.1	36.3	27.8	30.2	32.5
Harmony	16.3	16.5	16.7	0.53	0.49	0.47	30.8	33.7	35.5	26.9	30.0	31.6
Paulsen 1103	16.3	16.4	16.6	0.53	0.50	0.48	30.8	32.8	34.6	27.1	29.0	30.9
Own-rooted vines	16.1	16.3	16.4	0.54	0.52	0.51	29.8	31.3	32.2	26.0	27.4	28.5

new L.S.D. at 0.05 = 0.2 0.3 0.2 0.01 0.02 0.04 1.2 1.7 1.3 1.1 1.5 1.2

Table (4): Influence of some rootstocks on morphological characteristics of vegetative growth in Red Globe grapevines in 2008, 2009 and 2010 seasons

Characteristics Rootstocks	Average shoot diameter (cm)			Average shoot length (cm)			No. of leaves/shoot			Average leaf area (cm <sup>2</sup> )			Total leaf area/vine (m <sup>2</sup> )			Coefficient of wood ripening			Weight of prunings (Kg)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Dogridge	1.13	1.17	1.21	169.9	176.0	182.2	28.5	29.4	30.4	155.5	161.2	167.1	23.8	25.4	27.2	0.91	0.93	0.94	4.64	4.72	4.87
Salt creek	1.09	1.14	1.17	164.1	171.7	176.5	27.5	28.7	29.4	150.1	157.2	161.6	22.2	24.2	25.5	0.87	0.90	0.91	4.33	4.49	4.56
Freedom	1.05	1.11	1.13	158.4	167.4	170.7	26.6	28.0	28.5	144.7	153.1	156.2	20.7	23.0	23.9	0.85	0.86	0.89	4.04	4.27	4.43
Harmony	1.03	1.08	1.12	155.5	163.0	169.2	26.1	27.3	28.2	142.0	149.1	154.9	20.0	21.9	23.5	0.82	0.84	0.85	3.89	4.06	4.19
Paulsen 1103	1.02	1.05	1.10	154.1	158.7	166.4	25.9	26.6	27.8	140.7	145.0	152.2	19.6	20.7	22.7	0.80	0.81	0.83	3.82	3.85	4.06
Own-rooted vines	0.97	0.99	1.02	146.9	150.1	154.8	24.7	25.2	25.9	133.9	136.9	141.3	17.8	18.6	19.7	0.77	0.79	0.80	3.48	3.53	3.59

new L.S.D. at 0.05 0.09 0.08 0.09 12.3 12.7 12.4 2.1 1.6 2.0 12.1 11.5 11.9 3.7 3.5 3.6 0.07 0.09 0.06 0.62 0.58 0.65



#### 4. Some characteristics of vegetative growth

Data presented in (Table 4) show that most of vegetative growth parameters (shoot diameter, shoot length, number of leaves per shoot, leaf area, total leaf area/vine, coefficient of wood ripening and weight of prunings) responded positively to all rootstocks. Red Globe grafted onto Dog Ridge and Salt creek rootstocks recorded the highest values, followed in a descending order by those grafted onto Freedom, Harmony and Paulsen 1103 rootstocks which gave intermediate values, while own-rooted vines had the lowest values in this respect.

The maximum values of shoot length, total leaf area/vine and pruning weights and the highest number of leaves were given by vines grafted on Dog Ridge and Salt creek rootstocks as compared to own-rooted vines could be attributed to the total biomass produced in Dogridge and Salt creek rootstocks which provided the frame work for total leaf area which by its turn was reflected on the amount of old wood retained on the grapevine which may have positively affected the yield and bunch quality.

The results in this respect are in line with those of Williams and Smith (1991) who observed more vegetative growth of Cabernet Sauvignon, expressed in high values of biomass on vines grafted on Arawan Rupestris Gargin rootstock, with the lowest vegetative growth on St. George. Also, Fardossi *et al.* (1995) found that shoot growth of 'Gruner Veltliner' was slower on '5C' and 'Fercal', but more rapid on '1103P', '725P' and '125AA'; ripening occurred earlier on '1103P', 'G1' and 'Riparia Sirbu' than on the other rootstocks. In addition, Coldecarrera *et al.* (1997) reported that rootstocks '110 R', 'SO4' and '140 Ruggeri' had the most vigorous scions while '110 R' and '140 Ruggeri' had the most productive scions. Also, Ezzahouani & Larry (1997) found that the scion cultivar 'Italia' was most vigorous on rootstocks '101-14' and 'Rupestris du Lot'.

#### 5. Chemical characteristics of vegetative growth

Nutritional status of leaves, leaf content of total chlorophyll and percentages of total nitrogen, phosphorus and potassium and cane content of total carbohydrates were positively affected by all rootstocks (Table, 5).

As regards leaf total chlorophyll content, it was found that Red Globe grafted onto Dog Ridge, Salt creek and Freedom rootstocks recorded the highest values, followed in a descending order by those grafted onto Harmony and Paulsen 1103 rootstocks which had intermediate values, while own-rooted vines were found to record the lowest values in the three seasons of the study.

This result was supported by several studies on the effect of rootstocks on physio-biochemical processes in

scion leaves. In this respect, During (1994) studied the influence of rootstock on scion photosynthesis and concluded that the effect of rootstock on gas exchange parameters is as scion specific. In some cases, grafting increased the rate of photosynthesis more than could be attributed to changes in stomatal conductance. In addition, Bica *et al.* (2000) found that the effect of rootstock was significantly higher on chlorophyll content, stomatal conductance and quantum yield. Chardonnay vines grafted onto SO4 showed lower photosynthesis, quantum yield, stomatal conductance and chlorophyll content than those grafted onto 1103 P.

Concerning the effect of type of rootstock on leaf mineral content, it is apparent noticed that Dog Ridge and Salt creek rootstocks were the most efficient in nitrogen and phosphorous uptake but had an intermediate performance for the uptake of potassium, while Freedom rootstock ranked among the highest efficient stocks in potassium uptake as compared to own-rooted vines which had lower efficiency than grafted vines in assimilating the minerals in all seasons of the study.

Many reports dealt with mineral uptake and distribution of minerals in grapevines; it was noticed that the differences in nutrient uptake and distribution could be attributed to the genotype of rootstock which gives different absorption capability or tendency for some specific minerals. The obtained results are in agreement with those obtained by Tangolar & Ergenoglu (1989) who grafted 'Gruner Veltliner' onto 10 rootstocks and concluded that leaf N levels were similar for scions on all rootstocks. The leaf K<sup>+</sup> was found to be the highest in 'Rupestris du Lot' and '110 R', and leaf P was the highest in '110 R'. Fardossi *et al.* (1995) used the same scion and rootstocks and confirmed that leaf mineral concentrations could be influenced by the rootstock, but the changes were in the normal range. They also tested 'Neuburger' grape on 12 different rootstocks to determine the micro- and macronutrients in leaf blades and found that vines on the Euro-American hybrid rootstocks '26G' and '333 EM' showed the lowest K<sup>+</sup> concentrations. Brancadoro & Valenti (1995) grafted 'Croatina' onto 20 different rootstocks and found that K<sup>+</sup> content of must and leaves was significantly affected by rootstocks. They suggested that K<sup>+</sup> deficiency should be improved by choosing an appropriate rootstock.

The differences in nutrient uptake and distribution of the nutrients can also be interpreted in different ways. First, rootstocks may have different absorption capability or tendency for some specific minerals. In this connection, Bavaresco *et al.* (1991) pointed out that rootstocks with lime resistance have a 'strategy' to overcome chlorosis with high root iron uptake. Also, Grant & Matthews (1996) thought that different rootstocks might have different ability to absorb

phosphorus. In addition, Ruhl (2000) also found a high K<sup>+</sup> absorbing mechanism in some rootstocks, which would affect pH of fruit and wines. Second, translocation and distribution of nutrients may differ among rootstocks. In this respect, Giorgessi *et al.* (1997) found differences in number and size of the xylem vessels between rootstocks and own-rooted vines. Also, Bavaresco & Lovisolo (2000) confirmed that the chlorosis should be attributed to the different hydraulic conductivities between the rootstocks and the own-rooted vines for iron. Third, hormone synthesis of rootstock roots and their translocation may be different.

In this connection, Skene & Antcliff (1972) found different levels of cytokinins in the bleeding sap of rootstocks. For instance, rootstock '1613' contained less cytokinins in the sap, both on a concentration basis and in terms of the total amount passing to the shoot each day. Fourth, some nutrients might be assimilated mostly by roots, thus reducing the amount translocated to the shoots. In this respect, Keller *et al.* (2001) discovered that over 85% of nitrogen was assimilated by way of vine root metabolism.

Table (5): Influence of some rootstocks on chemical characteristics of vegetative growth in Red Globe grapevines in 2008, 2009 and 2010 seasons

Characteristics Rootstocks	Leaf total chlorophyll content			Leaf nitrogen content (%)			Leaf phosphorus content (%)			Leaf potassium content (%)			Cane total carbohydrates content (%)		
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Dogridge	37.3	38.6	39.8	0.66	0.69	0.72	0.33	0.35	0.37	0.38	0.40	0.42	0.29	0.30	0.32
Salt creek	36.1	37.6	38.6	0.63	0.67	0.69	0.32	0.33	0.36	0.36	0.39	0.40	0.27	0.29	0.30
Freedom	34.8	36.7	37.3	0.60	0.65	0.66	0.30	0.32	0.33	0.40	0.43	0.44	0.26	0.28	0.29
Harmony	34.2	35.8	36.9	0.59	0.62	0.65	0.29	0.31	0.33	0.35	0.38	0.40	0.25	0.27	0.27
Paulsen 1103	33.9	34.8	36.4	0.58	0.60	0.64	0.29	0.29	0.32	0.34	0.36	0.39	0.23	0.25	0.26
Own-rooted vines	32.3	33.0	33.9	0.54	0.55	0.58	0.26	0.28	0.29	0.31	0.34	0.36	0.20	0.21	0.23

new L.S.D. at 0.05 = 2.9 2.4 2.7 0.07 0.06 0.07 0.04 0.03 0.04 0.02 0.03 0.02 0.04 0.03 0.05

As for the percentages of total carbohydrates of the cane, it was found that Red Globe grafted onto Dogridge, Salt creek and Freedom rootstocks resulted in the highest significant increase as compared to own-rooted vines which resulted in the lowest values in the three seasons of the study.

The results in this respect are in line with those of Richards, (1983) who observed that the major functions of the grapevine root system are vine water relations, the uptake and translocation of nutrients, the synthesis and metabolism of plant growth substances and the storage of carbohydrates. Also, Satisha *et al.* (2008) observed that the maximum carbohydrate content was recorded in St. George, with the least carbohydrate measured in the 110R rootstock.

Data illustrated in Figures (1 & 2) indicated the presence of a positive correlation, between the total leaf area per vine (m<sup>2</sup>) and yield per vine (kg) and between the weight of prunings (kg) and yield (kg) in the three seasons of the study.

## 6. Economical justification of the contribution of some rootstocks in raising vine productivity compared with own-rooted vines:

It can be shown from the data presented in (Table 6) that Dogridge, Salt creek and Freedom rootstocks (as the best rootstocks) gave the maximum net profit compared with the own-rooted vines in the three seasons. In spite of the high costs of grafted plants compared with ungrafted ones. Hence, it can be anticipated that the added cost of establishment will be offset by an increase in vine productivity.

In conclusion, it can be said that Dogridge, Salt creek and Freedom rootstocks, achieved the best yield and its components as well as the best physical properties of bunches, improved the physical characteristics of berries, ensured the best vegetative growth parameters, improved the uptake efficiency of nutrients and increased total chlorophyll of leaves and total carbohydrates of canes in comparison with the ungrafted vines. Hence, it is recommended to graft Red Globe vines onto these rootstocks.

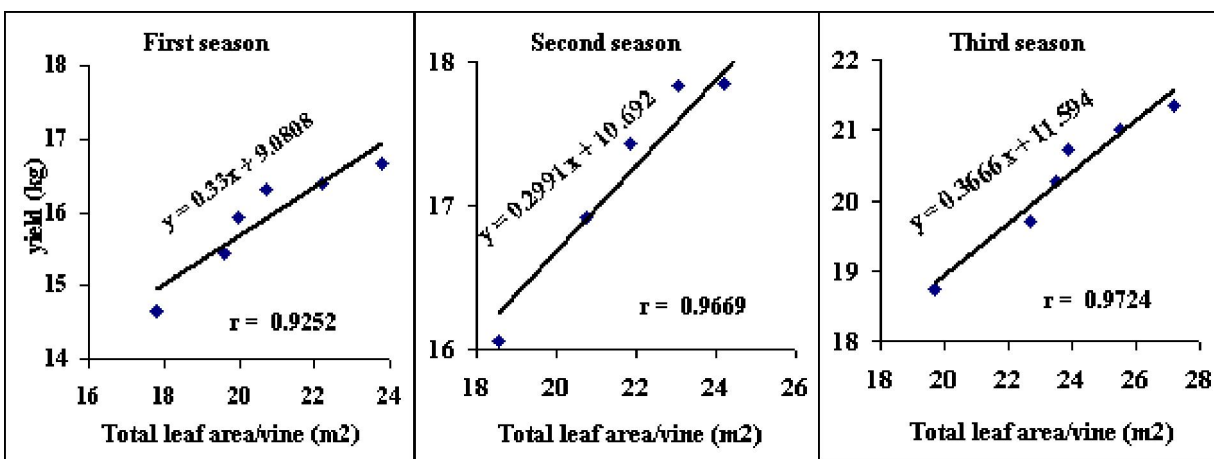


Fig (1): The relationship between the total leaf area (m<sup>2</sup>) and yield (kg) in the three seasons

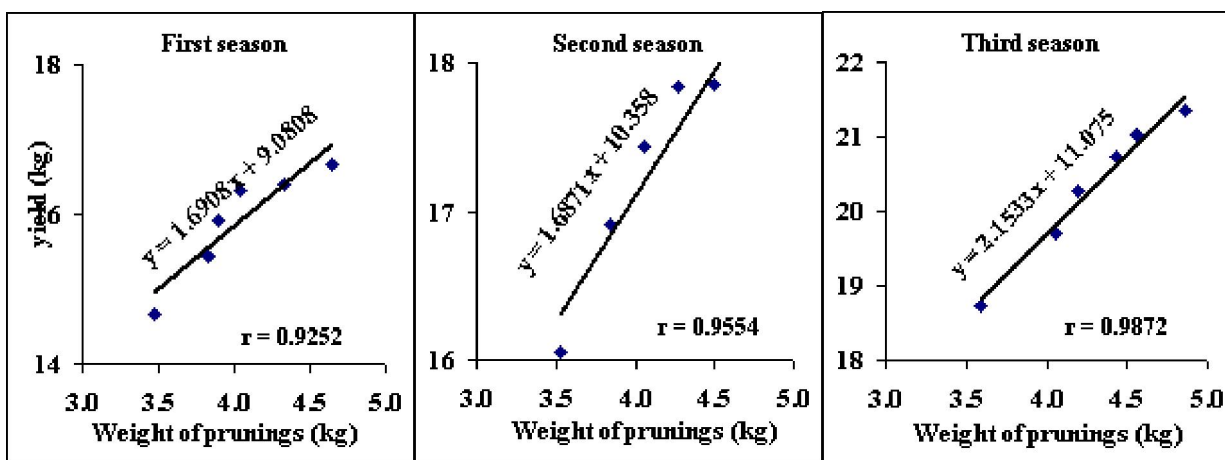


Fig (2): The relationship between the weight of prunings (kg) and yield (kg) in the three seasons

Table (6): Economical justification of the contribution of some rootstocks in raising vine productivity compared with own-rooted vines						
Per Feddan	First season					
	Dogridge	Salt creek	Freedom	Harmony	Paulsen 1103	Own-rooted
Price of the rootings (L.E.)	3500	3500	3500	3500	3500	700
Cost of cultural practices (L.E.)	2700	2700	2700	2700	2700	2700
Total cost (L.E.)	6200	6200	6200	6200	6200	3400
The increase in Cost of cultural practices over control (L.E.)	2800	2800	2800	2800	2800	---
Yield in (Kg)	11669.7	11483.1	11419.9	11146.7	10816.3	10259.8
Increase of the yield over control (Kg)	1409.8	1223.3	1160.1	886.9	556.4	---
Kg (L.E.)	2.00	2.00	2.00	2.00	2.00	1.90
Price of the increase in Kg over control (L.E.)	0.10	0.10	0.10	0.10	0.10	---
Yield (L.E.)	23339.3	22966.2	22839.9	22293.4	21632.5	19493.7
Price of the increase in yield over control (L.E.)	3845.64	3472.53	3346.20	2799.76	2138.84	---
The net profit (L.E.)	17139.3	20266.2	20139.9	19593.4	18932.5	16793.7
The net profit (L.E.) over control (L.E.)	345.6	3472.5	3346.2	2799.8	2138.8	---
Per Feddan	Second season					
	Dog ridge	Salt creek	Freedum	Harmony	Paullsen 1103	Own-rooted
Price of the rootings (L.E.)	3500	3500	3500	3500	3500	700
Cost of cultural practices (L.E.)	2800	2800	2800	2800	2800	2800
Total cost (L.E.)	6300	6300	6300	6300	6300	3500
The increase in Cost of cultural practices over control (L.E.)	2800	2800	2800	2800	2800	---
Yield in (Kg)	12675.1	12492.4	12487.2	12204.4	11837.5	11236.1
Increase of the yield over control (Kg)	1439.0	1256.3	1251.1	968.3	601.5	---
Kg (L.E.)	2.25	2.25	2.25	2.25	2.25	2.15
Price of the increase in Kg over control (L.E.)	0.10	0.10	0.10	0.10	0.10	---
Yield (L.E.)	28519.0	28107.9	28096.2	27459.8	26634.4	24157.6
Price of the increase in yield over control (L.E.)	4361.40	3950.37	3938.62	3302.24	2476.88	---
The net profit (L.E.)	22219.0	25307.9	25296.2	24659.8	23834.4	21357.6
The net profit (L.E.) over control (L.E.)	861.4	3950.4	3938.6	3302.2	2476.9	---
Per Feddan	Third season					
	Dog ridge	Salt creek	Freedum	Harmony	Paullsen 1103	Own-rooted
Price of the rootings (L.E.)	3500	3500	3500	3500	3500	700
Cost of cultural practices (L.E.)	2900	2900	2900	2900	2900	2900
Total cost (L.E.)	6400	6400	6400	6400	6400	3600
The increase in Cost of cultural practices over control (L.E.)	2800	2800	2800	2800	2800	---
Yield in (Kg)	14947.6	14714.1	14509.0	14190.3	13783.6	13109.8
Increase of the yield over control (Kg)	1837.8	1604.3	1399.2	1080.5	673.8	---
Kg (L.E.)	2.50	2.50	2.50	2.50	2.50	2.40
Price of the increase in Kg over control (L.E.)	0.10	0.10	0.10	0.10	0.10	---
Yield (L.E.)	37369.1	36785.3	36272.5	35475.8	34458.9	31463.5
Price of the increase in yield over control (L.E.)	5905.59	5321.75	4808.93	4012.23	2995.39	---
The net profit (L.E.)	30969.1	33885.3	33372.5	32575.8	31558.9	28563.5
The net profit (L.E.) over control (L.E.)	2405.6	5321.8	4808.9	4012.2	2995.4	---

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## The Methods Of Human Behavior Control In Traffic Control

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**Abstract:** Achieving better traffic control is always an enduring issue during these years, however a reasonable answer for this issue has not been got due to a number of factors that are involved in this issue and the complexity of the transport system itself. The key of traffic control is defining person as the object of traffic control, rather than car and traffic lights. Traffic control really works only when the implementation of traffic control could make the traveler's behavior more rational and safer and further format the more safe and effective traffic environment. Therefore, it is critical to undertake a study of human behavior control in traffic control. This study clarified the definition of human behavior in the field of traffic control and conducted a discussion on the controllability of human behavior in order to introduce a concept of traffic behavior control. In addition, according to the application of behavior in other subjects, 'Traffic Man' which is the object of traffic behavior control was introduced and the characteristics of this concept were also be analyzed in this study. Consequently, the main methods of human behavior traffic control were obtained based on the relationship of consciousness and behavior, the aspect of traffic behavior's feedback as well as traffic demand respectively.

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**Keywords:** traffic behavior ; traffic behavior control; 'Traffic man'; traffic behavior consciousness ; traffic behavior control method

### 1. Introduction

How to achieve effective and efficient traffic behavior control in the great road traffic system is still a complex problem. A number of factors should be considered. The major one is the differences between people. Because humans are individual organisms of different intelligence not the uniform robot, so the performance of traffic behavior cannot be the same. However, studying each individual's traffic behavior is impossible. Therefore, the aim of traffic behavior control is to achieve the target the general control of typical traffic behavior.

With the continuing development of traffic control, the study of behavior control is increasingly concerned in recent years. As to behavior, different disciplines may have different definitions. The most common one is that behavior refers to a conscious physical activity of intelligent organisms. For the traffic behavior control, this definition means the physical activity under the series of mental activity and consciousness in a particular environment.

### 2. Traffic behavior

Traffic behavior can be understood as: it originates from separate traffic demand, serves for the purpose of its social existence, with or without traffic tools, accompanied with a series of information and human mental process, and finally achieves traffic movement in certain road traffic environment.

In general, the transport behavior can be

divided into individual behavior and group behavior.

Individual Behavior--- the behavior which individual makes based on its understanding of the current situation and other personal reasons. Specific situation produces a specific stimulus. Because people have different backgrounds, such as age, sex, educational level, attitude, character, etc. So even in the same context, the responses of different people to stimulation may be vary significantly. In the study of traffic behavior control, individual behavior in the society rather than in isolated environment is the study object.

Group behavior--- the behavior which individuals in group perform may be completely different from that they do alone. When an individual joins a group, the individual behavior is converted to group behavior. In order to be integrated into the society, the individual holds the same basic expectations with the group which usually called herd mentality. The main factors of herd behavior are group atmosphere and individual quality. In groups, when individual behavior departs or deviates from the group behavior for the purpose of maximize the individual value, it may need some cost. The more the deviation is, the more cost it needs. Eventually, when the cost is high up to a certain extent, individual behavior returns to the group behavior.

In transportation, such as transportation mode choice behavior, overtaking behavior and parking behavior belong to the individual behavior.

Car-following behavior, travel behavior and pedestrian crossing behavior belong to group behavior. In real life, individual behavior and group behavior cannot independently exist but often intertwined. Therefore, the first step in practice is to determine the dominant behavior and then choose the effective control method.

### 3. The controllability of traffic behavior

Control can be simply understood as the process of the controller selecting or guiding the controlled-object's movement or change in a certain environment. Figure 1 shows the control system model.

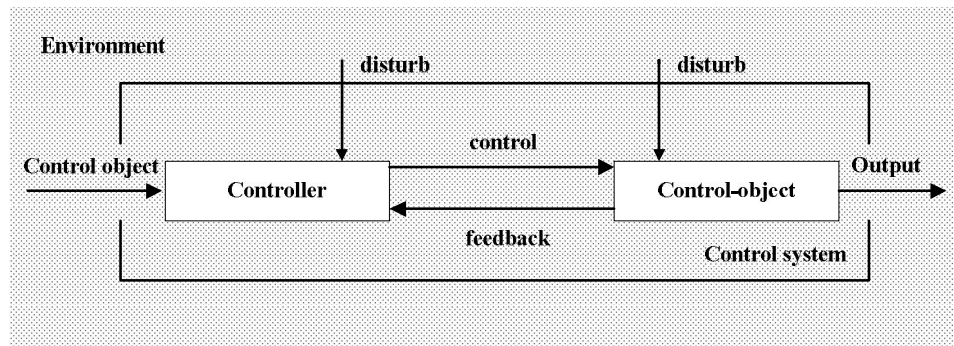


Figure 1 Control system model

Behavior can be controlled. Traffic behavior is social behavior. Its performance is not irregular, sudden, random and reasonless. Instead, traffic behavior was driven by the motivation with clear objectives and close interaction with environment. The controllability of traffic behavior is reflected in the following areas ;

1) The initiative of traffic behavior. The basic expectation of a traveler is obtaining transport services for their own when they are in traffic systems. Therefore, the initiatives always try to adapt traffic to self-centered and minimize traffic constraints. Therefore, the initiative of traffic behavior constitutes the background of traffic behavior uncertainty and becomes the starting point of behavior control.

2) The purpose of traffic behavior. Traffic behavior has subjective point that is the formation of behavior has been driven by the destination. The purpose and needs of traveler are various and adjustable. Therefore, guiding, changing or balancing a variety of needs can change the internal driving force of behavior and then achieve behavioral control.

3) The continuity of traffic behavior. When the behavior dominated by the target reaches before the aim, if the general conditions are not changed, the behavior usually does not end. People continue act and correct it by internal reason in order to keep close to the target.

4) The plasticity of traffic behavior. Every traveler believes that traffic resources are rich while hide security risk. Only flexible behavior can achieve the goal of controlling traffic behavior safely and use resources reasonably. Thus, the change of various environmental and psychological conditions will stimulate the modification and change of people's

behavior, so it can be served as a signal to control the behavior change, and finally adjust the behavioral efficiency and behavioral goals.

5) The motivation of traffic behavior. Human behavior is caused by individual's need and cooperated with the environment throughout the whole process and then maintained by personal motivation and goal-oriented. The motivation indicates that only commuting with environment can change, adjust and control people's behavior.

From the above analysis we can draw a conclusion that traffic behavior can be controlled.

### 4. The object of traffic behavior control

Traffic behavior can be controlled. The control object is not anyone but only refers to the people who participate in traffic system with their travel purpose. Using 'traffic man' to characterize the object of traffic behavior control, which should have the following assumptions:

1) Social Assumption. Traffic man should be the normal social people with social common sense, basic life pursuit and daily travel by transportation, etc. His requirements to transport are multi-level, not only for fast and convenient but also for security and other needs.

2) Rational Assumption. 'Traffic man' has thinking ability and when he choice the transport behavior his attitude is calm and objective. Before receiving certain traffic signals, he can convert it into the traffic information and then think how to do finally take action. Even act illegal traffic, he also knows the consequences of rational choice.

3) Project Assumption. The road transport

facilities are designed by the general physical characteristics and design engineering properties. Therefore, 'Traffic man' should have the basic characteristics of the traffic engineering design object, such as basic traffic knowledge, recognition of traffic signs and so on.

4) Psychological assumptions. Psychological characteristics of 'Traffic man' is normal and stable, in other words he has the normal process of cognitive and intention.

In previous studies, we refer 'traveler' as the study object of traffic control which usually means the person who travelling by some traffic tool on the road .But as expressed in figure2, this concept does not apply for traffic behavior control. Though travel is the most important part in the whole process, it is not all. Compared to 'traveler', 'Traffic Man' has a clear meaning and wide extension and exists in the whole process. So 'Traffic Man' is an accurate expression of the traffic behavior control object.

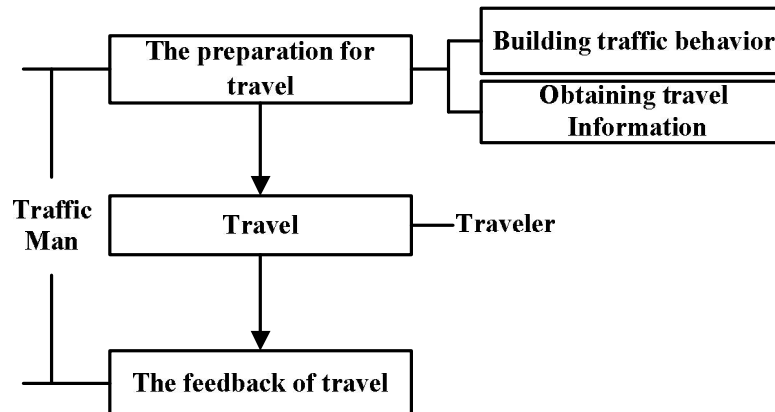


Figure 2 the difference between traffic man and traveler

## 5. The traffic behavior control method based on traffic behavior consciousness.

### 5.1. Traffic behavior consciousness

Behavior consciousness is the direct part that people affecting the behavior. It can guide and control human behavior, so it is the 'master switch' when

people select their behavior.

Traffic behavior consciousness can be divided into categories as traffic safety consciousness, traffic law consciousness and traffic order consciousness. The content and the establishment method of three traffic behavior consciousness are shown in Table 1.

Table1 Classification of Traffic Behavior Consciousness

Traffic Behavior Consciousness	Nature	Methods
Traffic Safety Consciousness	The consciousness of personal survival instinct. It cannot be lost or abandoned, but can be weaken or ignored.	self-consciousness, education, stimulation and , etc.
Traffic Law Consciousness	The consciousness of social life fundamental behavior. It can be strengthened and more depended on knowledge.	education, publicity, penalties, rewards, etc.
Traffic Order Consciousness	The consciousness of collaborative behavior. It is most vulnerable to disturbance and more depended on human nature	education, returns, personality-upgrading, etc.

### 5.2 Traffic behavior and traffic behavior consciousness

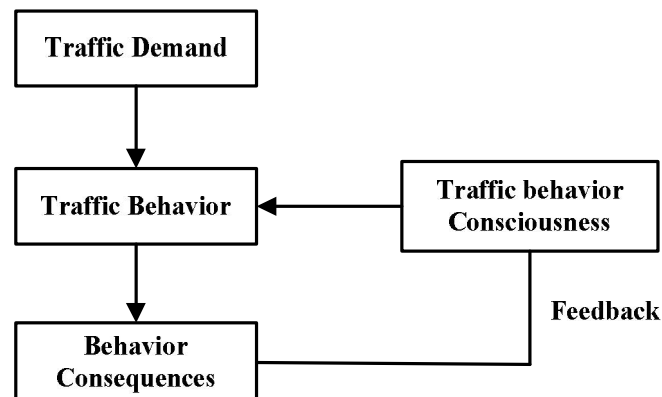
Dialectical materialism believes that matter determines consciousness and the consciousness of the

material has a dynamic counter-productive. This is the determined by people's initiative. People's social behavior is a conscious act and also is a variety of activities for living and developing in society. Human

behavior consciousness happens before human behavior. By analyzing the old knowledge memory saved in memory and the new knowledge recently acquired, the brain generates orders, plans, methods and programs which can control human behavior. It is the real objective reflection of the human brain to human life, survival needs and living environment. In other words, behavior consciousness based on cognitive behavioral outcomes (knowledge of the objective world) is the determine tendency of selecting real behavior and the performance of intentions, aspirations and ideas in activities. Therefore, behavior consciousness acts as the guide significance of human behavior. Behavior consciousness is always behind steady human traffic behavior and plays the role of the steering wheel which determines whether and how it happened.

There is no fixed shape of the behavior consciousness that it cannot be seen and touched,

however, the consciousness can be strengthened by a number of measures in order to play the leading role in decision-making process. Modern traffic behavior consciousness refers to the awareness and basic attitude of 'traffic man' about the properties, operating characteristics and social impact of modern urban transportation. As previously mentioned, traffic behavior consciousness can be divided into traffic safety consciousness, traffic law consciousness and traffic order consciousness. The high or low consciousness level directly determines the advantages and disadvantages of traffic behavior. Despite the consciousness exists in the brain, cannot directly seen or controlled, however, the level can be influenced by external factors stimulating people's consciousness and thus achieving behavior control. Figure 3 shows the relationship between traffic behavior and traffic behavior consciousness



**Figure 3. Traffic behavior and traffic behavior consciousness**

### 5.3 The method of traffic behavior

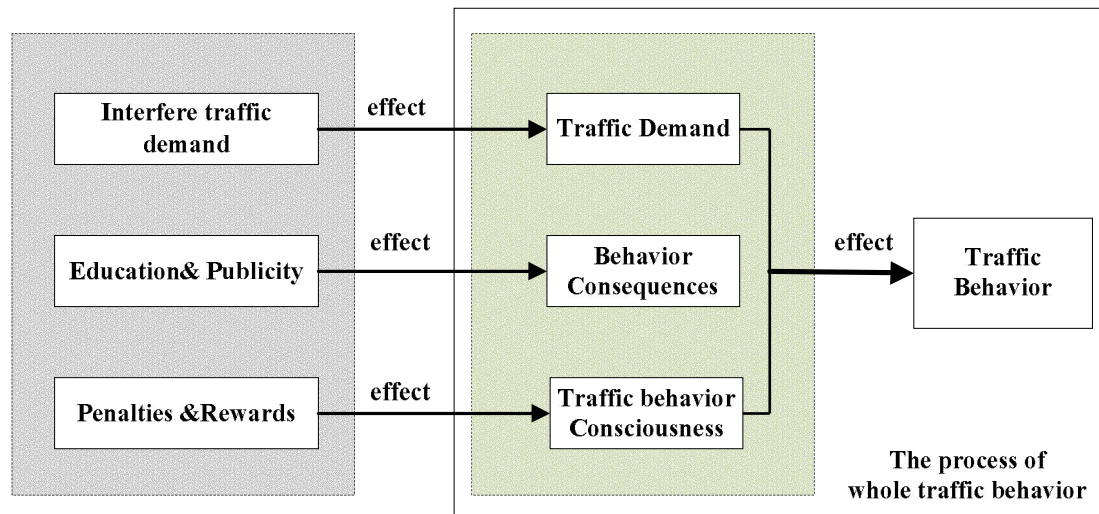
From the figure behavior- consciousness, traffic demand, traffic behavior consciousness and the consequences of traffic behavior will affect traffic behavior, so basic control method can be divided, that is interfere traffic demand, education& publicity and penalties & rewards. As shown in figure 4.

#### 5.3.1 Interfering traffic demand

In traffic behavior control, interfering traffic demand can impact on the generation and the manner, time, location and other characteristics of the generation from the source and structure. It is a method of taking the initiative to control the amount of occurring traffic demand and guide the spatial and temporal distribution of traffic demand, and finally change people's traffic behavior and traffic behavior

ideas by a series of measures. As transportation mode choice behavior for example, when the parking fees is lower, people who often choose car as transportation mode may comprehensively consider bus service, travel costs and other factors to decide travel by car or bus, the choice is random. But when the parking fees is high (especially the price exceeds the heart can accept), the parking fees may be as a major factor in the considering whether by car or by bus, and then select the low-cost bus. It is worth noting that each traffic demand management impacts on the transportation system in different aspects to some extent. In the application, the effects of taking a variety of comprehensively intervention measures not only are simply added but also interact with each other. Therefore, the demand impact of intervention should be preceded by comprehensive assessment.





**Figure 4. Traffic behavior control**

### 5.2.2 Education & publicity

Education and publicity can impact deeply on traffic knowledge, behavior mode and behavior consciousness through human sensory organs, which make people become elements of the road traffic system to receive system control. The important means of establishing and strengthening traffic behavior consciousness is the traffic safety education and publicity. They are only the tools and the real purpose is building traffic behavior consciousness and making it at high level.

Education is to build knowledge framework for traffic actors. Only storing certain knowledge, the traffic participants likely establish behavior consciousness. In other words, to get traffic participants generate a variety of traffic consciousness the first thing should do is let them know "what is safe", "what the content of traffic laws" and "what is the general order of road traffic". If one person knows nothing about road traffic knowledge, the traffic consciousness does not arise.

Publicity is transmitting certain information intentionally to the public to influent their opinions, attitudes and behavior and so on. The purpose is to stimulate traffic behavior consciousness always at a relatively high level by continuous information and finally guide traffic behavior better.

### 5.3.3 Punishment & rewards

For traffic behavior is repetitive behavior and learning behavior, so punishing illegal behavior and reward law-abiding behavior can improve behavior mode and finally achieve behavior controlling.

Stimulation can enhance people's consciousness, thereby affect behavior. Punishment or reward for individual behavior is a kind of stimulation.

There will be feedback and memory when individual under the various stimulations. In the daily traffic, reward those people whose traffic behavior performance are higher than the general level in a period of time can inspire other people to improve traffic behavior and also encourage the individual rewarded to motivate his future behavior more standard and demand strictly on themselves. Punishing those people whose traffic behavior is illegal or accident-caused can lead feedback to individual. This can stimulate he had to go regulate his behavior in traffic environment and get rid of bad practice. But punishment may have a negative effect, for example that someone who was punished for causing a traffic accident may dissatisfy with enforcement and likely not learn lesson, so the punishment not play the role and inappropriate punishment may even cause dislike or conflict which contrary to the original intention with the traffic enforcement. Therefore, grasping the degree and paying attention to the ways and methods to the traffic enforcement is very important, otherwise it will backfire.

## 6. Conclusion

The object of traffic behavior control is human. Therefore, the study must start from the human characteristics. Traffic behavior happens in a particular road traffic system, while the control method cannot be restricted in this particular system. This article undertook a research of traffic behavior in Management and Economics, then analyzed traffic behavior, the characteristics of the control object and the relationship between traffic behavior and traffic behavior consciousness, and finally raised the traffic behavior control based on traffic behavior consciousness. The main conclusions are listed as following:

1) From the behavior research of Management and Economics, the definition of traffic behavior was provided. Combining the controller principle and studying from the initiative, purpose, continuity, plasticity and motivation of the traffic behavior draw the conclusion that traffic behavior can be controlled.

2) Traffic behavior can be controlled. The control object is not everyone but the individual who enter the transportation system with some requirements needed to meet. This is called 'Traffic Man'. The assumptions of 'Traffic Man' characteristics were then analyzed and summarized.

3) Through the analysis of the traffic behavior consciousness, the consciousness will be divided into three categories, including traffic safety consciousness, traffic law consciousness and traffic order consciousness respectively.

4) By studying the relationship between traffic behavior and traffic behavior consciousness, the method of traffic behavior control was raised, based on traffic behavior consciousness such as interfering traffic demand, education & publicity and penalties & rewards.

The traffic behavior control method in this article is based on the behavior consciousness, which is only one method of behavioral control. The comprehensive and systematic traffic behavior control method needs to be further explored.

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3/15/2011

### Reviews the most important factors in improving criteria of rural women's empowerment

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**Abstract:** Rural women's financial self-reliance has many social & economic influence as it made them self-sufficiency, it changes economic behavior and it makes women independent, it will be effective in economic development in family & society, it also improve the women's roles in society and it causes self-confidence in women, it builds family strength and it causes to respect the women rights more than before and women will become equal with men in all their rights, of course we won't have patriarchy in the family. The women's empowerment in the rural society will increase because of all the aspects of rural women's self-reliance and their position will be confirmed. By the activities such as promotional services for increasing the rural women's skills in various fields and by increasing the rural women's knowledge in social, politic, cultural and economic fields and by using micro-credit plans for motivate and support women in economic development and their self-reliance, we can increase the rural women's empowerment.

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**Key words:** self-reliance, empowerment

#### Introduction:

In the development countries, rural societies which are poverty for geographic reasons such as being far from urban societies or because of mountainous of zone and also as the roads are impassable and some other reason, they became deprived of many human development programs. Unfortunately these societies are suffering of mortality because of poverty but what is clear here is that we can't attribute such privation to geography and nature of the zone. Every country is trying to solve such critical conditions by applying depoverity policies. (Bakhshoodeh and Salami, 2005)

Poverty spreading in village is a global issue. According to the Fao finding about % 75 of world's poor people that are more than 1 milliard people are living in rural zone and more than % 70 of this poverty people are women. As the most of the people who are poor are living in village and are women is the reason for insufficiency of rural development programs.

One of the other basic barriers in development of rural women is their independent inaccessibility to get credits for investment in their job. Although their illiteracy is the big barrier to use of bank credits, but this view that women are dependent people that their husband should decide about their financial decisions is the other reason that rural women couldn't access to official credits. Maybe these barriers are the reason why rural women are happy about applying micro-credit thought in village. (Najafi, 2007).

Having investment (capital) independency enforce people to think about economic from different angles. He should study the ways for using capital, he must consult with authority and experienced people and he will investigate about relevant markets. Such things will help him to be authoritative & independent. But how rural women can get such independency? Are the women created inherently for housekeeping, parenting and working or is there any opportunity for rural women to show their skills in economic & social development?

It seems that experiences which are obtained from performing financial programs in some villages in the developing countries could answer clearly to such questions.

A glimpse to previous planning about rural development in the world shows that from 1950 many developing countries understood that the main reason for making their economic growth (development) slowly in their countries is the weakness of investment in the agriculture part. Although many countries by patterning from developed societies have proceeded to improve & develop their industrial agriculture part and by this action not only had irreparable damages to many traditional farmers but also the main problem (the lack of capital sources) is also remained in the rural regions. (Rahimi, 2001).

From 1970, the waves of thought about micro-credits and run of small activity in villages was one of the suitable way get increased for invest improvement in rural occupations.

The said plan because of special grants such as giving loan with low wage and no interest and with long reimbursement could give farmers this opportunity to don't rely usurers and jobber intermediaries. Indeed giving micro-credits to rural women was more effective. Because along agriculture activities which need more investments, the women with using micro-credits couldn't only show their talent in rural production, but also could improve their economic & social empowerments and they could also participate in social activities. (Chabokru et al, 2005).

Women's self-reliance and independency were the outcome of giving credits to women and in some cases were the obstacle of receiving credits by women which is necessary to explain about them shortly.

### **Empowering rural women:**

Empowerment is capacity that woman can obtain in cultural and social environment, for economic independency and self reliance, by controlling over emotional decision making and far from violation. Empowering means, evolution and developing activities through non governmental organizations (NGOS) that lead empowerment to improve economic dimensions. (Amiri, 2000)

Enabling is process that, during it, people of society do activities to overcome barriers of advancement that finally cause their domination to determine their own density. The term "enabling" means overcoming fundamental inequalities. So it is different from self-reliance. (UNICEF, 1997)

Enabling, enables individual to overcome any problematic condition and consider barriers and problems as part of life and positive campaign. Finally, enabling provides energy to overcome most intellectual barriers and external problems at private life.

Thus, among all what have been said, it is possible to present suitable definition of enabling women, as follows:

"Process of explaining women about themselves (and also men about them) for instances that they must or want to do, and growth of their willingness and courage until they reach to needed competency "(management of rural and tribal women).

it should be noted here , that major factor which should be considered about women's ability , is eliminating individual and social barriers , and finally preparing field of economic and social participation for women at all fields . purpose of women's participation , is because of their dominance on all affairs of village including decision making process , organizations , forums , enterprising posts and ... that

involve , participation at all social and economic dimensions .

### **Criteria of empowering women:**

Enabling as a theory of policy making for women, in it present five criteria:

Welfare, access, Concientisation, participation and control.

#### **1- welfare criteria :**

In this criteria, men and women as human resources of development should enjoy of desirable welfare conditions and equality (Paknazar, 2000).

Most of timing developmental programs, have worked on base of women's welfare. They have considered and provided some services for women who were passive recipient of these services. But these services were limited to physical needs and mostly were considered to revive their role of productivity, again. sometimes , it has been said that this approach has begun at colonial era and has considered women from poor country and intended services for them that dose not exceed from that poverty level . Agricultural and industrial projects were designed for men and social programs for women and children. Most of welfare programs were inadequate or its success was limited. Considerable point in this criteria is that men and women as human resources of development should enjoy equality and desirable welfare conditions. At this stage, women's material welfare and their enjoyment of welfare programs, compared to men (nutrition, death rate and ...) were considered. And women's role as producer to supply their own needs isn't very important.

#### **2- access criteria :**

Lack of access or limited access for women to sources including (fields, job, capital and training) cause that their functions at production is less than men (Paknazar 2000). Access to facilities, sources, designed program and projects for women and access to schools and ... are in this part. Just whenever most of other legal, cultural and social issues being solved, men and women would equally access to sources and facilities. Concept of enabling at this stage is that women have equal right to access to sources at family and greater society.

#### **3- Concientisation criteria**

Women should know that their problems aren't due to their individual inefficiency and shortage but it has emerged by social system in which discriminations has become formal and acceptable issue. (Araghzadeh, 2002). This stage is more critical and important than other stages. Because women can participate at development activities not just be passive users. Women have real equality at development, just when be aware. Concientisation will help to increase women's ability to equality at

participation at society. At this stage, women face with critical analysis with society and will find that what has been considered natural and unchangeable reality, is changeable. (Bakhshoodeh, 2005).

#### 4- Participation criteria

One the most important items that this criteria has considered , is men and women's equal participation at decision making process of affairs of family at society (Paknazar 2000 ) . Men and women both should participate at process of assessment needs, designing, performing and evaluation of projects and development programs (UNICEF, 1998). In summary, this criterion means women's participation at all stages of surveying needs, detecting problems, planning, management, performing and valuation.

#### 5- Control criteria

This criterion emphasize on this point that in addition to equal access of men and women to development sources , they must have adequate control on these sources that this issue is balance criterion , between men and women so that no one exceed other one (Paknazar 2000 ) . Women should have opportunities for decision making at workplace and home. If woman is producer, should be shared with part of her interest and wage. Women like men, should be able to choose her individual and social field and able to make decision and also development activities should be facilitator of these processes.

FAO (food and agricultural organization) addresses these three purposes as strategic goals while enabling women:

- 1- equality between men and women to access production sources
- 2- women's participation at policy and decision making
- 3- decreasing rural women's workload and increasing job opportunity and income for them (Paknazar 2000 )

within theoretical framework of enabling women , having control on sources is presented as highest stage at women's participation process on development , but existing data at most developing countries , indicates that not only rural women haven't any control on financial resources of family but even they were deprived to access to sources and credits , specially through formal credits system (Shaditalab, 2002 ) .

The question that arises here is that what relation is there between enabling women and micro-credits programs? Nowadays, micro-credits are considered as effective mechanism to eradicate poverty for women. Interests of micro-credits further increasing women's income, include:

- improving women's role in family
- Increasing women's confidence, not only through obtain financial

success through business activity, but through increasing women's access to social services and communication with other women.

- Changing at social level (social class) at perspective of women's role.

#### Discussion and conclusion:

Supplying credits and analyzing credits approaches cause opportunity to activate poor men's working power , establishing field for sustainable production and income , prevent usurers and pre shoppers of agriculture productions to plunder poor rural men and finally empowering poor people especially women who can work but were deprived to have capital and work tools , and extension accordance to their activities such as needs assessment , identifying target group , organizing poor people , giving needed specialized and public training and ... have important role on effectiveness and make effective activities of these credits .

Woroniuk و Schalkwyk (1998) at their conducted research believe that now, micro credits, micro finance sources and small business unites are most effective mechanism to decrease poverty.

Plitt and others, conducted research as they called it "do credits programs, can empower women "? Results showed that corporation at credits programs helps empowering women.

Goetz و Sengupta (2003), presented negative image of credits effects on empowering women. They concluded that most women have minimum control on their loans. And when repayment period is short, this shortage of control has devastating effects on women welfare.

Hashemi and others (2004) found that joining to Grameen Bank, has meaningful positive affects on controlling women, and helps to family income.

In researches that conducted by Nanda (2004) became clear that women participation in credits programs had positive affects on their demand about health care.

Fiona Steele and etal (2008) in researches that conducted as called " influences of credits programs on empowering women at Bangladesh , found that women who joined to credits programs , have participated in more educational programs and have married with more educated men and also they have saved more and they had more cash .

Ellen and her colleagues (2009) used approach called it "credits and education at Bolivia, Ghana, Honduras, Mali and Thailand". This approach looks for empowering women through financial services with education. In this approach, women get familiar with importance of credits through education and



extension and also familiar with ways to access it through establishing different groups.

Shahnaj and chaudhury(2009) in research as “credits and its role on empowering women “ concluded that there is meaningful relation between attending in credits programs and empowering women , at economical dimensions .

Ruhal amin and others (2010) found that those who joined credit funds had more ability rather than those who didn't.

Jameela (2010) presented that credit programs has shown lot of affects on empowering women so that has increased their social, politic and economic ability.

Thus it is obvious that credits programs and its educational and empowering programs can be affective on social, humane and economic development or rural society, if it be associated with proper and gradual practices and base on reciprocal communications principles and apply opinion of local society.

Maybe the main challenges that threaten credits associations , is lack of necessary emphasizes on social dimensions and on reinforcing their basics , that practically cause that this social foundations lose its efficiency soon and practically changed to unsuccessful institution .

In order to overcoming dominant consideration, experts believe that we should consider following in protection process of these social institutions.

- establishing and reinforcing through supporting without ant direct government involvement
- evaluating and constant modifying of financial management mechanisms
- improving organization effectiveness
- establishing constant relation and interaction with similar and equal systems.
- establishing local , regional and national networks
- establishing support and cover systems in order to decrease risk
- establishing balance and interaction with financial systems greater decision making include: capital market (local, regional, national) and governmental.

also following suggestions have been offered:

- helping to marketing and establishing many exhibitions for member's productions, credit programs, guiding

and training them in line with group and workshop activity, can assist them on economic empowerment.

- since women have pointed to education deficiency as major barrier for empowering them , thus educating rural women at the field of exploiting different credits and channels of receiving credits , and also various educations , is so that lead to enabling them , that contain considerable importance.
- providing extension educations for men in order to believe economic role of their women , and give them chance of corporation on all economic , credits fields
- Since that base of credit association, forms base on People Corporation, so it's good chance to use these communities to expand extension-education activities. so it is better to consider special programs on different extensional filed such as agriculture , ranching , family health , housekeeping economy and other fields accordance to condition of region and rural women's needs .
- it is suggested that vast and exact programming happens at following fields:
  - a- extending insurance, facilities for amenities
  - b- educating women about awareness of their own individual and social rights
  - c- persuading rural women about importance of participating at cooperatives and other educational institutes
  - d- educating women about job management and income management

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## The General Equation Of Pipe To Soil Potential During Humidity Change By The Use Of Both Soil Factor and Protection Current For Pipe – Soil – Earth System

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**Abstract:** For pipe-soil-earth system, the buried pipe line segment with soil surrounding medium could be simulated electrically by an electric circuit where the system is subjected to the law: charge = capacitance  $\times$  voltage between the pipe surface and remote earth. This is where each of circuit electric parameter (electrolytic stray capacitor between pipe & earth, the stray potential across the stray capacitor, surface charge and the protection current of the cathodic protection system passed through the pipe segment ) could be obtained by an equation which is function of the measured electrochemical properties of the soil (soil factor), 4<sup>th</sup> degree polynomial at room temperature but the A's constants are different for each electric quantity .These constants of each equation (A's) considered to be as a print of such pipe-soil-earth system . The useful of these prints is to obtain complete electrical data correlated with many cathodic protection levels. One of the most critical problems in CP systems is the effect of a sudden change of the soil humidity around the protected pipe line. The behavior of the protection current demand of the pipe-soil-earth system during the change of the electrochemical properties of the soil could be plotted as protection current print which will be always valid in all times as the pipe-soil-earth system is maintained and without any external interference. In other words, if the system is subjected to humidity change, there will be another new protection current demand with new print for this pipe-soil-earth system to keep the pipe cathodically protected. Of course, as a result of humidity change, the pipe to soil potential will be changed. This paper tries to calculate segmental pipe to soil potential along the pipe line without the need of both the test point and Cu/CuSO<sub>4</sub> half cell by a general equation of the pipe to soil potential which is function of both the segmental protection current and the soil factor around the pipe segment during such humidity change.

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**Keywords:** Electrical study of pipe – soil – earth system

### 1. Introduction:

The behavior of the electrical parameters (stray potential  $V_{p-pe}$ , stray capacitor  $C_{p-pe}$ , surface total charge  $Q$  and protection current  $I_p$ ) of the pipe-soil-earth system, during the change of the electrochemical properties of the soil, with and without applying cathodic protection system, could be plotted as an electrical parameter PRINT which will be always valid in all times as the pipe-soil-earth system is maintained and without any external interference. Once the system is changed by replacement another pipe with different dimension and/or the replacement of the soil (of course, or by humidity change), there will be another new electrical parameter PRINT for the new pipe-soil-earth system. Also, the buried pipe line segment with soil surrounding medium could be simulated electrically by an electric circuit where the system is subjected to the law  $Q = C \times V$  between the pipe surface and earth. This is where each of circuit electric parameter could be obtained by an equation which is function of the measured electrochemical properties of the soil (soil factor), 4<sup>th</sup> degree polynomial at room temperature but the A's constants

are different for each electric quantity. The constants of each equation (A's) considered to be as a PRINT of such pipe-soil-earth system [10] [12]. The useful of these PRINTS are to obtain complete electrical data correlated with many cathodic protection levels which help, after complete erection of the pipeline, in defining the cathodic protection level of any pipe line segment through its length by measuring the protection current and calculating the soil factor at the pipe segment from direct field measurements. The average error of the electrical parameters equations reduced to be less than  $\pm 5\%$ . The most important advantage of such electrical analogue circuit of pipe-soil-earth system is the possibility to simulate a complete pipeline-soil-earth system by an electric circuit and to convert the corrosion problem and cathodic protection of the pipeline to an electric problem [11] [13]. In the near future after completing such electrical studies of the pipe-soil-earth systems, this will help in corrosion monitoring and the maintenance of c.p systems. Not only has that but also to define the most suitable route of the pipe line, before the erection process, which generates the minimum surface charge. The most important result is

that: the pipe to soil potential of any buried pipeline could be obtained segmental along its route without the need of both the test point and Cu/CuSO<sub>4</sub> half cell. This is by the use of the new electric concept of pipe-soil-earth system. One of the most critical problems in CP systems is the effect of a sudden change of the soil humidity around the protected pipe line. Of course, the electrochemical properties of the soil will also be changed. As a result, the demand of the protection current will also be changed. The questions now are: what is the proper value of the protection current to keep the pipe cathodically protected during humidity change? What is the value of the protection current required during soil dryness process? By the use of the voltage canister, new idea, which will be equipped with the intelligent pig, this paper tries to calculate segmental pipe to soil potential along the pipe line without the need of both the test point and Cu/CuSO<sub>4</sub> half cell by the deduction of a general equation of the pipe to soil potential which is function of both the protection current and the soil factor around the pipe segment during such humidity change.

## 1. Literature Review

### 2.1 The Soil Factor

As the electrochemical properties of any soil are changed by the change of humidity but returns back to its initial conditions after some time required for soil dryness, we can define a new factor named the soil factor as: "The soil factor ( $S_f$ ) is the instantaneous value of the electro-chemical properties of the soil based on the electrical properties at Humidity equal to 10% "[1] [2] and is equal to:

$$S_f = (1 / K_s) \text{ pH } H \log \quad \text{at room temperature} \quad (1)$$

$$\text{Dimension of } [S_f] = [1/K_s] [\text{pH}] [H] [\log] = .m \%$$

Where:

$S_f$  = soil factor .m %

$K_s$  = dielectric constant of the soil at  $H = 10\%$

pH = power of Hydrogen of the soil

$H$  = humidity of the soil %

= soil resistivity in .m at  $H = 10\%$

Figure 1 shows the range values of the soil factor due to humidity change for 10 soil samples under test.

The importance of the soil factor is that it is combining all parameters which can affect directly on the cathodic protection level or in corrosion process. Such factors which can be obtained by a direct measurements from the field. This means that if it is possible to study the relationship between the soil factor and the electrical parameters of the bare pipe

segment, then the print curves and the print constants of the electrical parameters of the pipe-soil-earth system could be obtained at natural condition with and without applying cathodic protection system. The soil factor can be considered to be as the key of many studies based on the new proposed electrical concept of corrosion. For an example, the general equation of the natural stray capacitance between external surface area of bare pipe segment and earth is obtained in terms of the soil factor with an average error  $\pm 30\%$  and its print curves and constants are obtained for pipe-soil-earth system for 10 different soils [3]. Also, the general equation of both the natural stray potential and the natural created charge are obtained in terms of the soil factor with an average error  $\pm 30\%$  and their print curves and constants are obtained for pipe-soil system for 10 different soils [4] [5]. Finally, the error of the general equation of the electrical parameters reduced to  $\pm 5\%$  [6] [7] [8] [9].

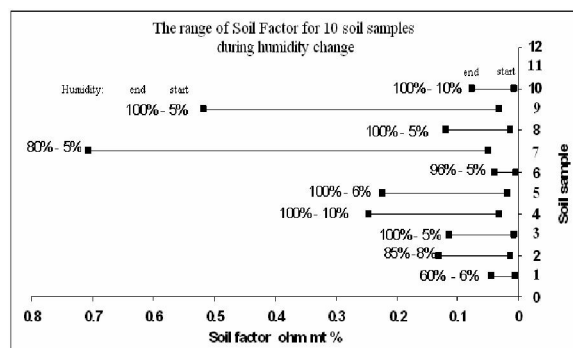


Figure 1: The range of the soil factor & humidity range for the soils under test

### 2.2 ONOIN Print Curves For Pipe-Soil – Earth System Under Test

The onion curves are the curves of the protection current  $I_p$  in terms of the soil factor  $S_f$  at different pipe to soil potential by the use of Cu/CuSO<sub>4</sub> half cell.

By considering the measured soil factor as x axis against the measured protection current as y axis at different cathodic protection levels, the next following print curves were obtained for the pipe-soil-earth systems under test. As an example, figures 2a & 2b show the ONION curves for boxes 10 & 19 respectively. From the print ONION curves and equations, it can easily observe that the general equation of the protection current of a cathodically protected bare pipe segment during humidity change under multi level of cathodic protection levels is a 4<sup>th</sup> degree polynomial equation which is function of the soil factor,  $I_p = f(X = \text{soil factor})$ . The protection current general equation is equal to equation 2:

$$I_p = A_{41} X^4 + A_{31} X^3 + A_{21} X^2 + A_{11} X + A_{01} \quad (2)$$

Where:

A's: =  $A_{(I)}$  are the protection current print constants of the pipe soil under test

X = is the value of the soil factor at certain humidity

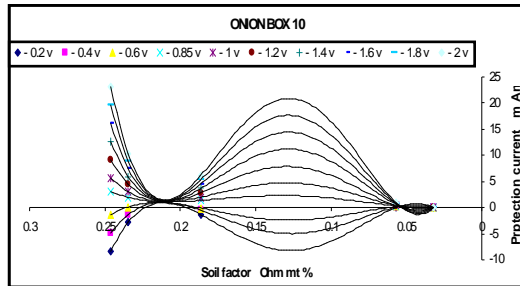


Figure 2a: The ONION curve for box 10

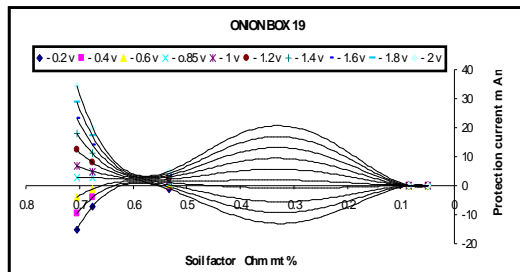


Figure 2b: The ONION curve for box 10

### 2.3 Protection current Print Constants For Pipe-Soil Under Test

Now, the protection current print constants of the pipe-soil-earth systems under test are  $A_{4I}$ ,  $A_{3I}$ ,  $A_{2I}$ ,  $A_{1I}$  and  $A_{0I}$  at a definite cathodic protection level. This means that these print values are valid for these CP levels for these pipe-soil-earth systems under test at any time at the correspondent electrochemical properties (the soil factor). Tables 1& 2 show result examples of the protection current print constants at CP levels equal to -0.6 & -0.85 volt respectively for all boxes under test.

### 2.4 Circular V PIG Idea: [1][2]

This is a new idea of the voltage drop technique to measure the protection current  $I_p$  passed through the buried pipeline. By considering a pipe line with total length  $L$  m, if such length is divided into segments with length  $L$  m/segment Then:

Total length  $L$  = segment length  $L_{Seg}$  × number of segments  $n$

Electrically, the pipe line could be considered as: total resistance = segment resistance × number of segments  $n$  as shown in Fig.3.

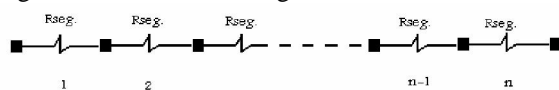


Figure 3: Electrical analogue resistance of the total pipe line length

Now if the voltage between points a & b of the segment is measured, as shown in figure 4, then the instantaneous measured protection current will equal to:

$$I_p = \frac{V}{R_{seg.}}$$

That means that an additional circular voltage drop canister could be added in the future with the available intelligent pig to measure the protection current  $I_p$ . Figure 4 shows such canister, and in the meantime by using GPS technology to determine the segment position. By the use of this voltage drop canister which pigged with the intelligent pig and by the use of GPS system, each segment flow current  $I_p$  could be measured.

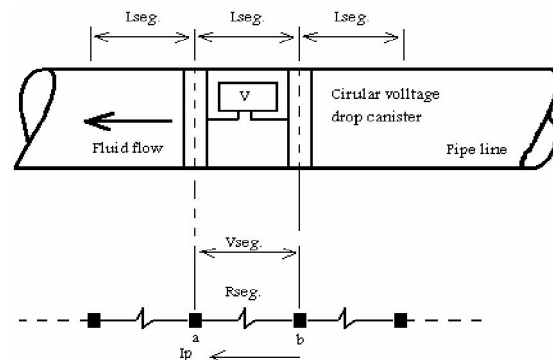


Figure 4: Idea of voltage drop canister to be pigged with the fluid through the pipeline

Then by measuring the humidity around this pipe segment, the soil factor could be determined. Finally, from the ONION curves obtained before [9] (which correlate  $I_p$ ,  $S_F$  and  $V_{H.C.}$ ), the equivalent pipe to soil potential of this buried pipe segment could be determined without the need of test point and without the need of Cu/CuSO<sub>4</sub> half cell. The most important result is that: the pipe to soil potential of any buried pipeline could be obtained segmental along its route without the need of any test points. This target could be achieved by another technique which is a direct calculation of the pipe to soil potential from a general equation. This paper deduces this general equation of the pipe to soil potential for all boxes under test

### 3. Analysis

As we said before, the print A's of the protection current passed through the pipe segment could be obtained from the general equation of the protection current (2) and easily we can construct the print of the protection current A's table for all boxes under test at pipe to soil potential, by the use of Cu/CuSO<sub>4</sub> half cell, from -0.2V up to -2V as per tables 1 & 2 as an examples. The questions now are: is it possible to rearrange the table results such that to be as the



protection current A's for each box against the pipe to soil potential? This is as per table 3 as an example for the protection current A's against pipe to soil potential for box 19. What would be the results for all boxes under test?

#### 4. Results

##### 4.1 $A_{0I}$ print constant

The protection current  $A_{0I}$  print constant is linearly proportional to the pipe to soil potential  $V_{H-C}$  measured by Cu/CuSO<sub>4</sub> half cell. Figure 5 show box 19 as an example and the correlation between them is

governed by equation 3 for all boxes under test as follow:

$$A_{0I} = B_{1A0I} V_{H-C} + B_{0A0I} \quad (3)$$

##### 4.2 $A_{II}$ print constant

The protection current  $A_{II}$  print constant is linearly proportional to the pipe to soil potential  $V_{H-C}$  measured by Cu/CuSO<sub>4</sub> half cell. Figure 5 show box 19 as an example and the correlation between them is governed by equation 4 as follow:

$$A_{II} = B_{1AII} V_{H-C} + B_{0AII} \quad (4)$$

Table 1: The PRINT  $I_p$  constants of the pipe current at pipe to soil potential equal to -0.6 volt

	1	2	3	4	5	6	7	8	9	10
	Box 1	Box 4	Box 9	Box 10	Box 13	Box 18	Box 19	Box 24	Box 27	Box 28
$A_{4I}$	2.00E+06	0	-212996	-58661	-1.00E+06	-4.00E+07	-1249.7	-64520	-1997.6	-1.00E+06
$A_{3I}$	-144117	-4412.5	48599	30400	655922	3.00E+06	1653.4	15344	1804.1	133859
$A_{2I}$	3880.2	640.72	-3607.7	-5064.1	-94674	-55418	-642.13	-1283.8	-485.31	-43141
$A_{II}$	-28.355	-14.944	97.032	294.94	3510.5	466.03	65.66	48.437	38.626	69.402
$A_{0I}$	0.0623	0.108	-0.5228	-5.1853	-36.066	-0.9527	-1.8728	-0.4347	-0.7779	-0.3237
Equation Error	0	70%	0	0	0	0	0	0	0	0

Table 2: The PRINT  $I_p$  constants of the pipe current at pipe to soil potential equal to -0.85 volt

	1	2	3	4	5	6	7	8	9	10
	Box 1	Box 4	Box 9	Box 10	Box 13	Box 18	Box 19	Box 24	Box 27	Box 28
$A_{4I}$	7.00E+06	0	14928	32198	-452755	-1.00E+07	-206.05	23296	4596.1	4.00E+06
$A_{3I}$	-636953	-6222.8	9230.9	-16158	216364	906336	296.05	1329.2	-4408.8	-617139
$A_{2I}$	17742	1138.7	-1749.1	2569.4	-30555	-25814	-117.82	-596.87	1202.1	26816
$A_{II}$	-148.86	-25.216	99.925	-129.41	1138.9	371.13	12.562	47.276	-66.944	-345.35
$A_{0I}$	0.3781	0.1582	-0.6199	2.0098	-11.767	-0.8843	-0.366	-0.5009	1.054	1.3383
Equation Error	0	30%	0	0	0	0	0	0	0	0

Table 3: Protection current print constants of box 19 at pipe to soil potential equal to -0.2 volt to -2 volt

	Box 19									
$V_{H-C}$ Volt	-0.2	-0.4	-0.6	-0.85	-1	-1.2	-1.4	-1.6	-1.8	-2
$A_{4I}$	-2919.6	-2084.6	-1249.7	-206.05	420.24	1255.3	2.09E+03	2925.2	3760.1	4595.1
$A_{3I}$	3825.4	2739.4	1653.4	296.05	-518.53	-1604.6	-2.69E+03	-3776.5	-4862.5	-5948.5
$A_{2I}$	-1481.1	-1061.6	-642.13	-117.82	196.83	616.33	1.04E+03	1455.3	1874.8	2294.3
$A_{II}$	150.62	108.14	65.66	12.562	-19.303	-61.787	-1.04E+02	-146.75	-189.23	-231.71
$A_{0I}$	-4.2838	-3.0782	-1.8728	-0.366	0.5383	1.7439	2.95E+00	4.1549	5.3604	6.5659
% error	0	0	0	0	0	0	0	0	0	0

**4.3  $A_{2I}$  print constant**

The protection current  $A_{2I}$  print constant is linearly proportional to the pipe to soil potential  $V_{H-C}$  measured by Cu/CuSO<sub>4</sub> half cell. Figure 5 show box 19 as an example and the correlation between them is governed by equation 5 as follow:

$$A_{2I} = B_{1A2I} V_{H-C} + B_{0A2I} \quad (5)$$

**4.4  $A_{3I}$  print constant**

The protection current  $A_{3I}$  print constant is linearly proportional to the pipe to soil potential  $V_{H-C}$  measured by Cu/CuSO<sub>4</sub> half cell. Figure 5 show box 19 as an example and the correlation between them is governed by equation 6 as follow:

$$A_{3I} = B_{1A3I} V_{H-C} + B_{0A3I} \quad (6)$$

**4.5  $A_{4I}$  print constant**

The protection current  $A_{4I}$  print constant is linearly proportional to the pipe to soil potential  $V_{H-C}$  measured by Cu/CuSO<sub>4</sub> half cell. Figures 5 and 6 show boxes 4 & 19 as an example and the correlation between them is governed by equation 7 as follow:

$$A_{4I} = B_{1A4I} V_{H-C} + B_{0A4I} \quad (7)$$

Table 4 shows the result table of protection current print constants (A's) in terms of pipe to soil potential for all boxes under test

Table 4: The protection current print constants (A's) in terms of pipe to soil potential for all boxes under test

		1	2	3	4	5	6	7	8	9	10
		Box 1	Box 4	Box 9	Box 10	Box 13	Box 18	Box 19	Box 24	Box 27	Box 28
$A_4$ I	$B_{1A4I}$	-	-	-	-	-	-	-	-	-	-
	$B_{0A4I}$	2.00E+07	0.00E+00	7.23E+04	3.34E+04	1.00E+06	1.00E+08	4.17E+03	3.52E+04	2.64E+04	2.00E+07
	error	H	H	H	0%	H	0%	0%	0%	0%	H
$A_3$ I	$B_{1A3I}$	2.00E+06	7.24E+03	1.57E+04	1.70E+04	6.59E+04	7.00E+06	5.43E+03	5.63E+04	2.49E+04	3.00E+06
	$B_{0A3I}$	1.00E+06	6.99E+01	1.43E+04	1.29E+04	1.00E+06	8.00E+06	4.91E+03	4.92E+04	1.67E+04	2.00E+06
	error	H	0%	0%	0%	H	H	0%	0%	0%	H
$A_2$ I	$B_{1A2I}$	-	-	-	-	-	-	-	-	-	-
	$B_{0A2I}$	5.53E+04	1.99E+03	7.41E+03	2.75E+04	9.94E+04	1.22E+04	2.10E+03	2.77E+03	6.75E+03	1.21E+04
	error	0%	0%	0%	0%	H	H	0%	0%	0%	H
$A_1$ I	$B_{1I}$	4.81E+02	4.11E+01	1.23E+01	1.52E+03	3.70E+03	4.01E+02	2.12E+02	5.25E+00	4.22E+02	1.53E+03
	$B_{0I}$	2.63E+02	9.69E+00	8.94E+01	1.17E+03	5.49E+03	7.27E+02	1.93E+02	5.17E+01	2.92E+02	9.79E+02
	error	0%	0%	0%	0%	H	0%	0%	0%	0%	0%
$A_0$ I	$B_{1A0I}$	-	-2.00E-01	3.93E-01	2.57E+01	3.79E+01	-3.07E-01	-	2.59E-01	7.33E+00	6.15E+00
	$B_{0A0I}$	-7.00E-01	-1.20E-02	-2.85E-01	1.99E+01	5.63E+01	1.17E+00	5.49E+00	-2.80E-01	5.17E+00	3.97E+00
	error	5%	0%	0%	0%	30%	5%	0%	0%	0%	0%

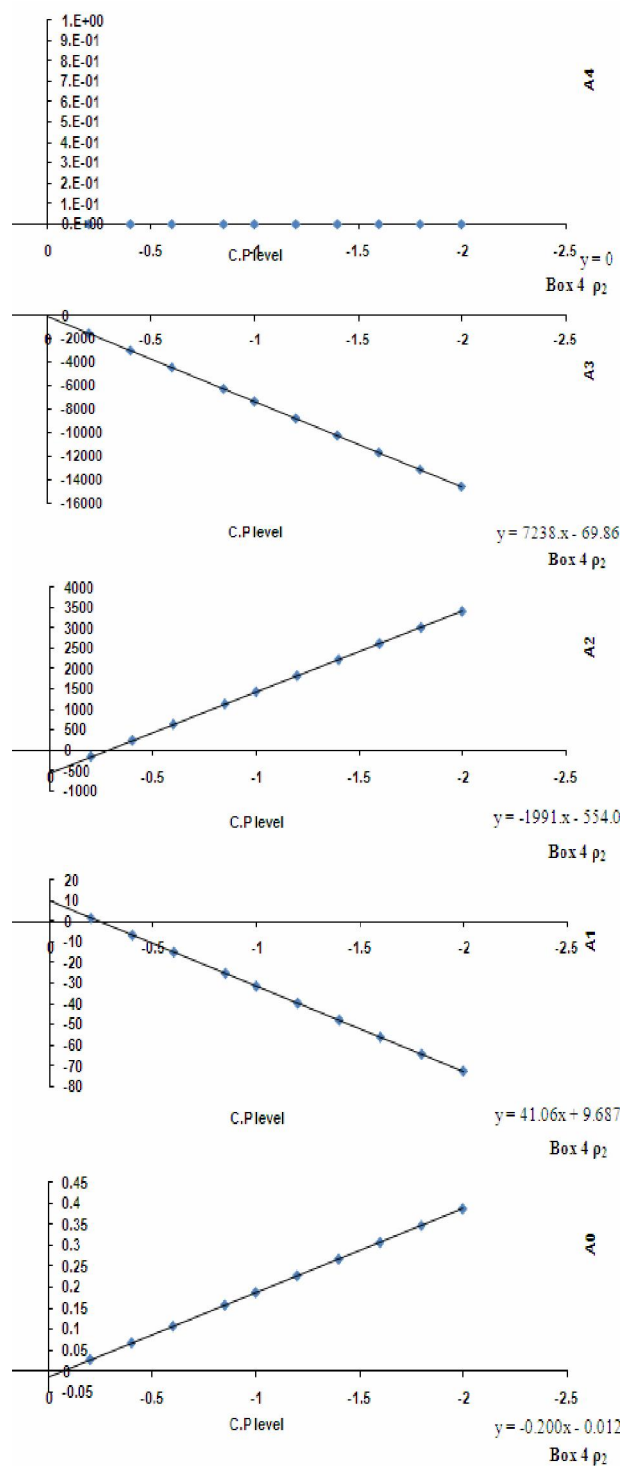


Figure 5: The protection current print constants against pipe to soil potential for box 4

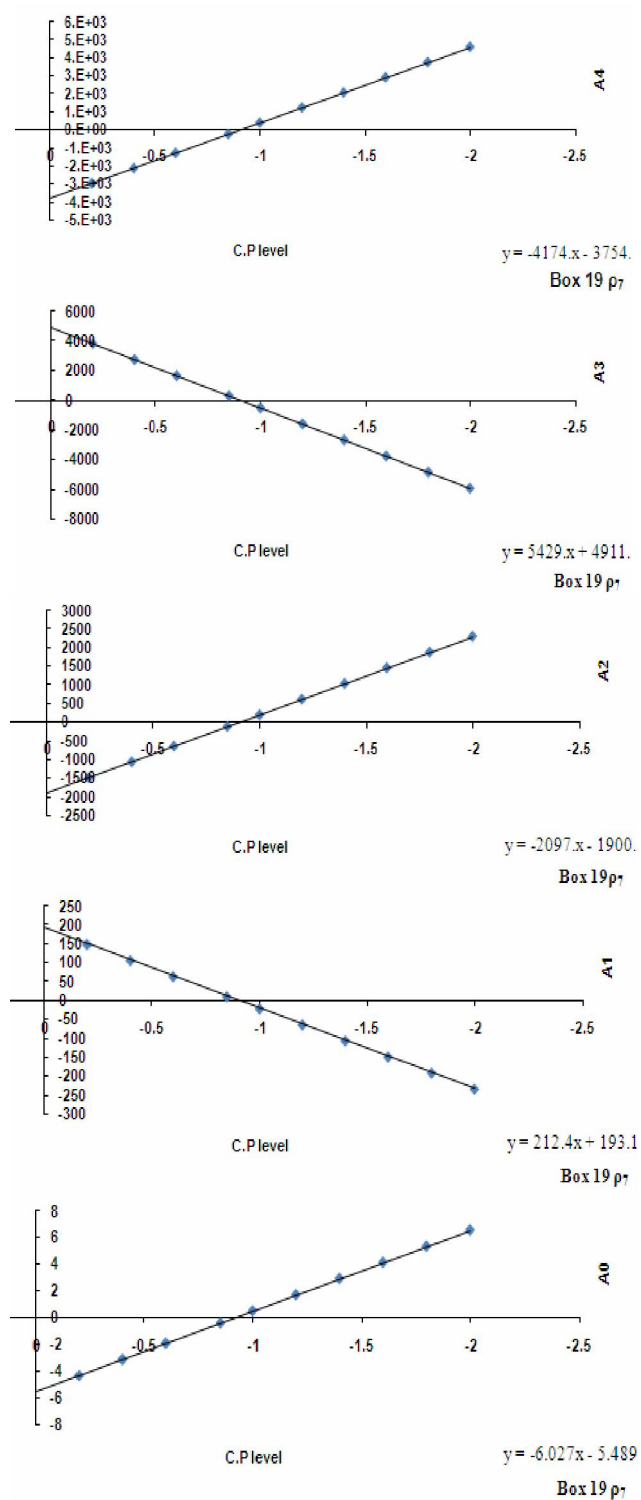


Figure 6: The protection current print constants against pipe to soil potential for box 4

#### 4.6 The deduction of the general equation of the pipe to soil potential

We have the protection current general equation from equation 2 as follow:

$$I_p = A_{4I} X^4 + A_{3I} X^3 + A_{2I} X^2 + A_{1I} X + A_{0I} \quad (2)$$

Where:

A's: =  $A_{( )I}$  are the protection current print constants of the pipe soil under test

X = is the value of the soil factor at certain humidity

By substituting the values of A's from equations 3, 4, 5, 6 and 7 in equation 2, the general equation of the pipe to soil potential will equal to equation 8 as follow:

$$V_{HC} = \frac{I_p - [B_{0A4I} X^4 + B_{0A3I} X^3 + B_{0A2I} X^2 + B_{0A1I} X + B_{0A0I}]}{[B_{1A4I} X^4 + B_{1A3I} X^3 + B_{1A2I} X^2 + B_{1A1I} X + B_{1A0I}]} \quad (8)$$

Where:

$V_{HC}$ : The equivalent value of the pipe to soil potential in volt measured by Cu/CuSO<sub>4</sub> half cell.

$I_p$ : Segmental protection current in m Amp measured by the voltage drop canister of the intelligent pig.

X: Segmental soil factor in .m%.

B's: New print constants of pipe-soil-earth system

Table 5 shows the error for all boxes under test while tables 6 & 7 are showing the detailed comparison between the pipe to soil potential obtained by equation 8 and the pipe to soil potential obtained by direct measurement by the use of Cu/CuSO<sub>4</sub> half cell for boxes 4 & 19 respectively during humidity change..

Table 5: Error table between theoretical and experimental values of pipe to soil potential for all boxes under test during humidity change

Resistivity	1	2	3	4	5	6	7	8	9	10
Box No.	1	4	9	10	13	18	19	24	27	28
Av. Error	H	± 10 %	± 15 %	± 35 %	H	± 35 %	± 5 %	H	± 10 %	H

Table 6: Comparison between theoretical and experimental values of pipe to soil potential of box 4 during humidity change

Box	Electrical Parameters			PH	H	Pipe to Soil Potential		Error
	$V_{P-PE}$	$C_{P-PE}$	I			Theoretical	Experimental	
	Volt	nF	mA		%	$V_{HC}$ - Volt	$V_{HC}$ - Volt	
4	0.1480	-0.570	0.0002	7.0	45%	-0.476829528	-0.4910	2.8860432
4	-0.2710	-0.570	0.4000	7.0	45%	-0.557774389	-0.5640	1.103831794
4	-3.7100	-0.570	5.1000	7.0	45%	-1.509352292	-1.3700	-10.17170015
4	-6.3900	-0.570	8.6000	7.0	45%	-2.217974135	-2.1110	-5.067462573
4	-9.3800	-0.570	11.1000	7.0	45%	-2.724132594	-2.6400	-3.186840686
4	-11.4400	-0.570	13.0000	7.0	45%	-3.108813023	-3.0000	-3.627100771
4	0.1000	45.600	0.0010	6.9	80%	-0.663867462	-0.5190	-27.91280574
4	-0.2050	45.600	0.3300	6.9	80%	-0.690445272	-0.5520	-25.08066515
4	-4.2800	45.600	7.9000	6.9	80%	-1.301977249	-1.3400	2.837518756
4	-6.3700	45.600	11.2200	6.9	80%	-1.570178856	-1.7000	7.636537911
4	-10.1500	45.600	15.9000	6.9	80%	-1.948246181	-2.2600	13.79441678
4	0.1930	70.000	0.0033	6.5	85%	-0.664663193	-0.6020	-10.40916827
4	-0.2140	70.000	0.1530	6.5	85%	-0.676743878	-0.8800	23.09728664
4	-2.9500	70.000	16.0000	6.5	85%	-1.955585621	-1.7800	-9.864360757
4	-4.9000	70.000	29.6000	6.5	85%	-3.053096047	-2.5500	-19.72925675
4	-6.8000	70.000	40.0000	6.5	85%	-3.892368726	-3.2300	-20.5067717
4	-8.5500	70.000	47.8000	6.5	85%	-4.521823235	-3.7700	-19.94226087



Table 7: Comparison between theoretical and experimental values of pipe to soil potential of box 19 during humidity change

Box	Electrical Parameters			PH	H %	Pipe to Soil Potential		
	$V_{P-PE}$	$C_{P-PE}$	I			Theoretical	Experimental	Error
	Volt	nF	mA			$V_{HC}$ - Volt	$V_{HC}$ - Volt	%
19	0.1276	8.000	-0.0002	7.0	55%	-0.591185741	-0.5520	-7.098866132
19	-0.2490	8.000	0.3000	7.0	55%	-0.6986547	-0.6230	-12.14361155
19	-3.6500	8.000	3.0000	7.0	55%	-1.665230946	-1.4060	-18.43747837
19	-6.3200	8.000	5.2000	7.0	55%	-2.452811591	-2.0600	-19.06852382
19	-9.3000	8.000	7.7000	7.0	55%	-3.347789596	-2.8400	-17.87991536
19	0.0340	13.900	-0.0008	6.5	75%	-0.68121396	-0.6650	-2.438189508
19	-0.1920	13.900	0.1900	6.5	75%	-0.694328432	-0.6950	0.096628523
19	-4.0000	13.900	9.1000	6.5	75%	-1.306749508	-1.2500	-4.539960668
19	-6.6300	13.900	15.7000	6.5	75%	-1.76039475	-1.7300	-1.756921981
19	-9.8300	13.900	24.5000	6.5	75%	-2.365255073	-2.2800	-3.73925758
19	0.2700	72.000	0.0062	5.3	96%	-0.75561634	-0.7070	-6.876427114
19	-0.4400	72.000	0.1506	5.3	96%	-0.761007335	-0.7370	-3.25744026
19	-3.1300	72.000	14.0000	5.3	96%	-1.278057518	-1.2900	0.925773821
19	-4.7500	72.000	24.7000	5.3	96%	-1.677528755	-1.7000	1.321837922
19	-6.6900	72.000	35.8000	5.3	96%	-2.091933497	-2.0800	-0.573725824
19	-8.2000	72.000	46.2000	5.3	96%	-2.480204607	-2.4400	-1.647729778
19	-1.0700	72.000	57.4000	5.3	96%	-2.898342724	-2.8000	-3.512240159

## 5. Conclusion

One of the most critical problems in CP systems is the sudden humidity change in the soil around the protected pipe line. Electrochemistry helps to determine the integrity of buried pipe from corrosion by measuring pipe to soil potential by the use of Cu/CuSO<sub>4</sub> half cell. In electrical study of pipe-soil-earth system we are now able to calculate the value of the pipe to soil potential from the protection current flow through the pipe segment as an electrical parameter, the electrochemical properties of the soil around this pipe segment as the soil factor and finally by the use of B's print constants of the pipe –soil-earth system. By the use of voltage drop canister which will be equipped with the intelligent pig to measure the segmental protection current through the pipeline, this will help to calculate the correspondent value of the pipe to soil potential for each segment of the pipe however long it is. This will help in pipeline both monitoring and maintenance, not only that but also to define the most proper current values during humidity change.

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**Indigenous knowledge and need for integration with modern science**<sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi<sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran

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**Abstract:** main reason for inattention for native knowledge in third world countries is that colonist countries don't pay any attention to the peoples' knowledge and information in these countries and always have reminded the people of these colonized countries as a stubborn, superstitious and retrogressive people. On the other hand, the colonist countries attention to industrial productions and agriculture policies has caused to promote industrial and single product agriculture which will influence the native farmer's knowledge about different productions and will make it inconspicuous. Also, colonized plans and imported extension programs have intensified the alienation of native knowledge. In the middle of 1980 decade, there was a new view "giving priority to farmer" that increased the attention to native knowledge.

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**Keywords:** indigenous knowledge, modern science

**Introduction:**

By first of 21 century, world see some sings of great concerns about social, economic and environmental system sets. It is expected that world population reach to 8 billion people at 2025. Increased consumption and poverty have led to high pressure on environment. At so many areas, environment condition is more fragile than before. We have faced decay at environmental issues, especially at vast parts of developing areas of world, in spite of considerable improvement of rivers conditions and air quality at some area such as Europe and north of America. Increased consumption, rare sources and factors such as population growth and imbalanced growth, would endanger, development of different countries (Popzan, 2002). Obviously, economic development can follow unexpected social and environmental affections involving weather changes, using freshwater sources inordinately, decrease living diversity and increase inequality (Gigler, 2003). Sustainable development is outcome of development that follow multi dimensional economic activities with protect environment and its related social issues. So in current decade, presenting indigenous knowledge issue was reinforced in order to present modern approach of development, in which the issue of human-oriented of development would be insisted. In this modern attitude toward development process, environmental, social and cultural concerns were emphasized over economic interests. Indigenous knowledge is part of national capital of each nation

which encompasses their beliefs, values, practices, tools and local acknowledges. This is the same knowledge that, different nations had found their foods from nature, prepared their clothing, settled in

home, educated their children, organized their society and kept health of themselves and poultries, during the centuries thereby (Eshraghi, 2004).

Indigenous knowledge of each nation has enabled them to supply their needs from natural sources without reducing these sources. So, indigenous knowledge collection of world is valuable source of practices and time-tested tool that would be useful for sustainable development of all societies.

At third world countries, unconsidered triumph of world development policies has led to various social, economic, cultural and environmental issues (Agrawal, 2002).

**Definition of indigenous (native) knowledge:**

Different definitions were presented about indigenous knowledge by experts that each of them present their idea about this knowledge from their viewpoint. Each of them emphasis on a special aspect of indigenous knowledge according to their viewpoint. Oxford vocabulary define the word indigenous knowledge such this "it is created naturally in a region which is related to the people of that region. (Azkia and Imani, 2008). Indigenous knowledge is a knowledge that has been grown in a long time and has transferred from one generation to other generation in hereditary form (Karami and Moradi, 2003). Williams and Molina have defined indigenous knowledge such this: indigenous knowledge is the learning methods, understanding and attitude to the world which is the result of experience and solving problems according to test and error by the people who are active and have used their available resources on its suitable time. Chambers with emphasizing on people's role in development process, believed that the phrase rural people's knowledge is more sensible than the other

phrase such ethnic ecology, ethnographic knowledge, ethnic classification. He also believed that indigenous knowledge is a knowledge that is created naturally and is emanated from geographical circle. (Chambers, 2000).

#### **Indigenous knowledge and sustainable rural development:**

unlike development that is dependent on using maximum of natural sources in order to current generation's access to maximum economic growth and income, sustainable development insists on supplying current generation's needs without jeopardizing next generation's facilities for supplying their needs. Policy making is impossible and unacceptable with no program that leads to starvation, poverty, social inequality and environment pollution at cities and villages and finally to ecologic devastation. In contrast, kind of development is acceptable that leads to continues improvement of life quality for all global society and next generations. Accessing to this goal is possible just through protecting natural sources and sustainable use of these sources.

Accessing to indigenous knowledge would enforce primary foundation of sustainable development. On the one hand, indigenous knowledge is production of empirical learning process and at the other hand is test and error of few thousand years of one society in relation to its environment. It is obvious that this knowledge represents human's interaction with nature and displays features of climate and specifications of vegetation and animal nature of one region and more important, it displays their interactions with human (Kolawole, 2001).

By possessing this valuable information it is possible to predict its component relations, and it is possible to use of its latent power intelligently so that both balance be preserved and also human's needs be supplied.

At the other hand furthermore valuable latent information in indigenous knowledge, villager's epistemology would enforce relation between experts and local men. This issue is possible through deep analyzing of indigenous knowledge and familiarizing with local people's attitudes and epistemology and through that raft between men and experts would be restored. Everything is inter-related at village and intelligent rural people by considering accessible things in nature or easily is obtainable, would supply their needs (Box, 1999).

Broaching indigenous knowledge issue in order to presenting new approaches was reinforced in current decade which insists on human-oriented developing and sustaining. In this attitude, development process, environmental, social and cultural considerations,

was considered important in addition to economic interests. Principle of sustainable development can be summarized so that development should be consistent with desired society from aspects of sustainable environment, fair social aspect, and from economic efficiency and cultural viewpoint. Considering people's indigenous knowledge was emphasized directly or indirectly as one of the development needs, at most of forty principles of sustainable development charter. Considering indigenous knowledge means accepting variation principle and describes that all people share and participate at variation and culture richness and they create common human's heritage. Sustainable development would not be able to be success without identifying people's indigenous knowledge, role and its position and also without protecting knowledge and indigenous people's rights, because indigenous knowledge has most consistency with principle of sustainable development (Karami and Moradi, 2003). Necessity of attention to indigenous knowledge was appeared more due to failure of common development samples, especially at rural development, and being attracted to it to help formal knowledge was identified very critical. At the context of cooperative approach as new approach that is based on paradigms which forms concepts of development, focus on new revolution is emergence of new proficiency that is called indigenous knowledge. Cooperative approach is seeking to systematic use of indigenous knowledge at related researches to technologic actions.

According to different definitions of indigenous knowledge, it is possible to count it as part of unique culture of each ecosystem or country and that is knowledge and findings which obtained through experience in order to be consistent with certain ecosystem conditions, and changed as part of social and productive culture of that society over time. This acknowledges, represent compatibility methods with nature and establishing reasonable relationship between human and his environment. And has complete harmony with principle of sustainable development, from this viewpoint (Burger, 1997).

#### **comparison of native and modern knowledge**

Native knowledge is different from modern knowledge in some cases that we will explain them as follow:

- Modern knowledge is reductionism (atomistic) but native knowledge is holist
- Native knowledge is reductionism (atomistic) and modern knowledge is holist
- By using native knowledge we can reach to a sustainable agriculture and modern knowledge doesn't have this feature.

- Government organizations have known native knowledge unreliable but modern knowledge is supported by scientific organization and institutions.
- Native knowledge is available for rural people but modern knowledge is not (Rajasekaran and et al, 1996).

#### **compilation of native and modern knowledge:**

Many experts believe that for making a sustainable development, native and modern knowledge should be combined. Nowadays, so much efforts have done to make use of native knowledge but main part of these efforts were done for derivation and making it scientific (Burger, 1997).

Amiri Ardakani and Shah vali (2003) believe that the undesirable outcomes of development on people and rural environment is the result of using new science by scientist, so by blending and making relation between modern and native knowledge we can solve this problem.

Millar believe that by combining native and modern knowledge we can make trust between researchers and rural people, because by using this way researchers and rural people know themselves as a partner that are responsible for a common process and product. Millar believe that the trust is the reason for future development (Penny, 2001).

Experts believe that there is no way to reach sustainable development except to combine native and modern knowledge.

Native and modern knowledge will complicate when:

- 1- We solve structural barriers such as political, economical, cultural and social difficulties.
- 2- We correct the thoughts on educational systems by emphasizing on learning and thought process and also correct the thoughts on research systems by emphasizing on audience and beneficiaries needs.
- 3- We solve communication barriers that cause inactivity on relation process and steady and dynamic flow of knowledge between peasants, experts and scholars. (Emadi and Amiri Ardakani. 2004).

Nowadays, making scientific native knowledge in agriculture had devoted important part of native knowledge researches to itself. Creation forestry cultivation system which is taken from indigenous exploitation pattern in forested region is the result of making scientific native knowledge. Stimulus cultivation of fruit trees with other production was usual by farmers in developing countries from one hundred years before (Louise, 2000).

Environmental problems because of forest destruction, made scientist interested to use of forestry's methods and ways and forced them to make these ways scientific. Scientist had specified the physical and biological compatibility between different species and it is output according to laboratory studies and has identified compatible trees and productions. Then they supplied package sets by new title such as forestry cultivation, multi-cultivation and ecological agriculture systems and give them to farmers in commercial and formulated packages. Making native knowledge scientific is meaning to find its efficiency scientific reasons. In the process of making native knowledge scientific, most of the experts and researchers are not aware of cultural aspects of ways and native methods. If derivation of native knowledge and making it scientific was without attention to cultural aspects and governing values on indigenous society, it couldn't be acceptable among native people.

Experiences show that native people would not accept methods which are not compatible with their belief and needs even if it had had scientific bank roll (Emadi and Abbasi, 2001).

#### **reaching to sustainable development through native knowledge:**

Dictated pattern's failure through western development countries to third world countries show that native knowledge is necessary to reach development.

Untrop believe that usage of local knowledge is efficient and useful in development and native knowledge's researchers believe that they achieved to an important source for innovation in agriculture methods and a good farming production to improve the rural people's life. On his idea, some of researchers call native knowledge as a good supplement and replacement for modern knowledge and they have tried to spread the usage of this knowledge all around the world. These plans as a "communion research with farmers" or "first is the first" are introduced. In this research method, private organs and local groups have the main role and unlink the current research plans, the tests are done with the farmers attendance in their farms and not in research centers and far from environment condition. The ways that farmers and rural people use for management of their living environment are the most scientific ways, although we couldn't understand it at the first sight (Chambers, 2000).

Eshraghi (2000) explained that by introducing sustainable development model or development environmental model and according to world food organization (FAO), sustainable development will create when applied technologies in rural



development are in proportion with rural people's knowledge and also are acceptable by them. Also he says that one the main ways to reach sustainable development in society is that to have enough and necessary attention to the rural's native or local knowledge (Merrewij, 1998). It is also explained that attention to this knowledge needs a complete recognition of rural people and their knowledge that through assembling of this knowledge we can find a correct way to reach a sustainable development and we should know that the movement toward sustainable development is not possible without correct using of native knowledge. Many development experts believe that the Sustainability of this concept is at the studying of this knowledge and in becoming popular in development. Indeed, native knowledge with its holist features had known the relation between nature's components better and had smoothed the way to Sustainability of development (Gigler, 2003).

We can summarize the usage of native knowledge in development as fallow:

- 1- Protection and maintenance of natural sources. Native methods in management of natural sources are suitable pattern for managing natural sources in sustainable development.
- 2- The success of sustainable development plans is depended to rural people's communion at designing, schematization, performance and assessment. Use of native knowledge is necessary for rural people's communion.
- 3- Native and modern knowledge should be combined because according to our needs and vulnerability of remained natural sources, none of them are able to remove our needs a lonely.
- 4- For recognizing development needs, trouble shooting problems should be polestar from rural people's view and recognizing problems and making efficient relation with rural people are possible through native knowledge.
- 5- In industrial countries, native methods are forgotten completely because of using modern knowledge in production process. As native methods are the most suitable way for achieving sustainable development goals so, many efforts were done to make this knowledge alive.

As a result not only we shouldn't forget the native knowledge but also we should use of this knowledge in developmental plans. Using native knowledge in developmental projects will help to have sustainable

development in villages. So developing and not developing that were using of western development patterns for many year, should use of their native and local knowledge which is the result of many years experience and by helping these plans they can reach to a sustainable development(Brouwer, 1998).

#### **Conclusion and discussion:**

also , necessity of considering indigenous knowledge at developing extension programs is emanated from where that is considered as principal components and sustainable human development items is emanated from same sources. At sustainable human development, people are considered as "goal" of social and economic policies that their range of their selections would be extended in order to actively participate at decision making. Therefore, people's participation is one of tools of sustainable agriculture development. But active rural people's participation at extension programs as a form of sustainable would not be possible unless by believing role of rural people's knowledge, vision and skills. Necessity and importance of indigenous knowledge and sustainable human development prepared field for establishing "united nation conference, about nature and development" at 1992.

this conference was established due to complaints against damaging environment in order to prepare basis for active indigenous people's participation at legislation and policy making , how to manage sources and related activities to development ; and also if people presented some suggestions about recent subjects , so find way to practice them. Failure of moved technology to rural societies also manifested necessity of considering indigenous people and their knowledge. At the other hand, considering indigenous knowledge is essential to help formal knowledge; because indigenous expert's attendance beside other experts has very critical importance. For example, indigenous peoples know condition of their regional epistemology, very well. Thus, their attendance is very affective for extending incompatible technologies with condition of region and at least, it conceives propagators to test these innovations at small scales and under natural condition and helps to extend them at larger scales, after being ensured of their appropriateness.

Finally native knowledge as a constant structure, with many years experience could attain a deep understanding and insight of the environment and ecologic exchanges. This knowledge is conveyed to next generation and the next conveyed it to their children. Native knowledge is on the verge of destruction like a curative prescription that has hidden a constant glamour on it. By dying each native person, the great treasury of knowledge will

lay underground and these knowledge sources are destroying very speedily.

On the research which was done by Bozarjomhari (2004) with this title "analyzing native knowledge position on rural sustainable development". It was specified that although there are many differences between native and modern knowledge but they are not in contrast with each other, because they are each other's supplement and we can't be success when we use them separately. According to new parameters in rural development, for solving rural problems, at the first we should use of native solutions and if it was not efficient, we can use and test external solutions.

Research findings which was done by Emadi and Amiri (2004) with this title " compilation of native and modern knowledge is necessary for reaching agriculture sustainable development" signify that The believe of educated people to native people and their knowledge " precondition for making them close" is called combination and compilation. Making evolution in modern system for attention to tentative knowledge is the main necessity for this compilation. Another necessity for this evolution is the researcher's attention to experimental accumulated wisdom and historical exploit by using qualitative and communion methods. Also applying compilation methods and making evolution among government, educational centers, farmers and peasant is the necessity and pre condition for combination of modern and native knowledge.

Research findings that was done by Karimi with this title " native knowledge in development process" signify that native knowledge was a essential element and important source for realization of sustainable development, poverty reduction, making local people capable and motivate them to participate in activities for agriculture and rural development, developing and product suitable technology, rural society's self-reliance and self sufficiency. For this reason all side's try, partnership and protection for record and registration, compatibility, distribution and promotion , exchange of this resources and also suitable and scientific guidelines for compilation of this knowledge with new knowledge and rural and agricultural development plans are needed.

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**Increasing social participation of rural women through micro-credit**<sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi<sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** In all communities, rural women are considered as an important factor in achieving rural development goals and in fact are half of the manpower needed for rural development. However, in the rural community of Iran, there are gaps between the ruling class (capital owners) and villagers, between literate and illiterate, and between men and women. Especially in villages women have fewer possibilities in terms of investment and less power and credit. Role of rural women, over of men, is more influenced with different economic, social, cultural and ecologic factors. Rural women are considered as a noticeable potential in the community either directly (crops production, livestock, handicrafts, cottage industries) or indirectly by helping the agricultural sector (as labor). About 5.6 million women are involved in agricultural production, and activities related to planting... harvesting, preparation of animal food, and taking care of livestock and poultry and some certain activities related to trading and marketing are all different fields of rural women's role and participation. Based on current statistics, women in rural area participate about 50% in conversion industries, 22% in producing crops and livestock, 75% in handicrafts and in areas related to planting...harvesting , respectively, 25, 24 and 4.26. And also in activities related to livestock, they handle 23% of livestock grazing, 42% of animal care and 100 percent of total poultry in the village.

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**Keywords:** participation, rural women, micro-credit

**Introduction:**

Rural women are among those major groups at society who previously were considered less by planners, due to specific reasons in the past. And this problem is more observable at developing countries. While, by looking at women's history of economic and social life, we can find that this great group, continuously have played basic role in forming economic condition of country. This great group consistent with men have had active role at areas of social-economic activities and always have had major part on economic production of society. Nowadays, supporting family supervisor women is adopted by universal society, as politic, economic a social concern and nearly all countries applied related approaches, and however these efforts have resulted in failure, in so many cases (Banihashem, 1999). paying part of cost of life by government or charities , establishing forums to analyze family supervisor women's problems , supplying necessary facilities to grow and improve child's life quality and paying facilities to provide sustainable employment , are among most important approaches to support family supervisor women . Paying credit facilities to access sustainable employment with easy terms at limited time, is one of the most important approaches to support family supervisor women. Because alongside supplying their continues needs, their esteem wouldn't be marred. Currently, this approach is used at many countries and positive results have emerged. (Ghaffari, 2000).

Aforementioned plan, due to containing special advantage such as giving accessible loan with low commission fee and no interest rate and also long-term repayment, could provide chances for many farmers to release from dealers and broker jobbers. In this approach, giving micro-credits to rural women seems more effective. because alongside agricultures activities that needed more investments , women by enjoying of very micro-credits not only could create remarkable creativities in rural productions but also gained worthy economic and social abilities , and even improved their field of social presence , well .( Lahsaeizadeh, 2000).

If rural women can work through receiving credits , loan and others finance facilities at favorite jobs and live through earned income (as it called "self-reliance and independence") , so undoubtedly we would see changes in social, economic and cultural relations of village.

Here, Basic issue is that if changes happened following of these events in villages, have positive aspects or negative? Naturally, every change in institutions and social phenomena has both positive and negative dimensions. (Farghdan, 2001)

Being high and low of each one is depended on various conditions and terms so it is varied from one society to another society. In Iranian rural societies, cultural and social context is such that, consequences of these phenomena maybe being different and sometimes contradictory. However these actions caused that women stand in good economic condition and also gain self reliance and rely themselves with

no help from husbands, but dominant cultural space on villages may create some disorders. At most of villages in Iran, patriarchal with all features dominate and women's financial self reliance may not being pleasant for some human and rural groups. When women gain financial independence in villages, impacts and social and cultural consequences would emerge. (Chabokru and etal, 2005)

Increasing Suffrage, lack of relying on vast patriarchal families, increasing cultural acknowledgment, relation with newer institutions, having intellectual independence, making decision for marrying, occupation, emigration and etc are those rights that they gain. gaining aforementioned rights by women in context of cultural and social framework followed some changes that maybe lead to disfunctions and even create disorders and abnormalities at traditional , familial and kinship relations that dominated on villages (Fakhraee 2002). What that performing credits programs, has made in recent years, was on broad outlook with purpose to access to same results as above findings.

Thus, in one inclusive outlook , it is possible to use micro-credits programs to solve those issues which involved with rural women's economic limitations , so that lead them toward social empowerment, in the context of economic growth(Rahmani andalibi, 2001) .

Nowadays micro-credits and supplying micro financial resources, has changed human's life and cause to revive different societies at poorest and richest countries of world, so that we can see growth in human's power to access to common financial services. By accessing to wide range of financial tools, families according to their priorities, invest on cases such as costs of education, healthcare, healthy and good nutrition or housing.

Applicants for Microfinance resources mostly involved family supervisor women, pensioners, homeless people, frugal workers, small farmers and micro entrepreneurs. These people are divided into four groups: Poor, very poor, relatively poor and vulnerable poor.

Whenever repayment afford , bond terms and accessing to data , in this classification will change , in order to supply sustainable financial needs of various clients , procedures and operation structures will be develop .( Fami, 2001)

Generally, in most countries, micro finance sources are considered for poor women. By women's access possibility to finance services, they committed to loan and ensure its repayment and preserve their saving accounts and also enjoy insurance cover. Supplying programs for micro financial resources have strong message for families and societies. Most of qualitative and quantitative studies and researches

have proven that accessing to financial services; will improve women's conditions in family and society. Women's confidence has increased and they are aware of their abilities. (Banihashem, 1999)

Thus, it has proven that supplying financial services for poor peoples is powerful tool to decrease poverty so that make them able to establish finance, increase income and decrease vulnerability against economic pressures.

### **Rural women's participation:**

Women, being half the population, play an effective role in the economic welfare of family and society. In Iran's economy, women are one of productive factors, but, so far, researchers and writers have ignored the issue of women's participation in economic activities. While in present situation considering the role of women's participation seems to be obligatory (Balali, 2005).

Participation in its broader sense means to motivate people and thus increase the sensitivity to understand and become responsive of development programs and it also carries the concept of local initiatives.

In fact, participation is to guide people caught by disability, to help them realize their potentials and to empower them to make the best use of life.

According to preceding definition of participation, and the ability of participation to turn potential into imminence power, women should participate more actively in economic affairs. Statistics regarding women and girls' activities, especially in rural areas, are always presented much lower than the real numbers (Ghaffari, 2000).

Village with the word "woman" removed will lose its literally in production and economic activities, their everyday activities in different fields all are evidence of woman being required in rural production. Rural girls and women are responsible for a variety of roles and duties including wife, mother, producing crops, livestock and agricultural activities, making and marketing handicrafts which are common in each area, and food preparation.

Daily activities of girls and women in different fields all are evidence of woman being required in rural production sector. Women are the major potential for developing the rural economy which leads to further growth of rural production. Increasing awareness towards the role of this class in production and towards necessity of their broader participation in economical and social development, have forced the countries to consider and support their activities while making new rural, Local and national policies (Rahmani Andalibi, 2001).

Being aware of women and girls' important role in rural activities, many countries have established institutes and organizations to advance women's progress. These organizations try to remove legal barriers that prevent women to participate in development activities as much as men. And finally improve their social, political and



economic status in society. With continues evaluation and analysis of current development plans, we can provide especial conditions to ease women's access to production recourses and social services, and considering women's social situation in every society, we can provide the opportunity for them to increase their participation, share income like men, and take part in decision-making(FAO, 1998 ).

#### **Major obstacles to women's participation:**

Considering society's current conditions and the issues mentioned above, major obstacles which result in women's less participation can be classified as follows.

##### **1- Educational barriers**

Apparently, one essential factor for development is education. Studies indicate that compared with men and boys women and girls do not have sufficient access to education. Some of the factors effecting women's access to education are:

1. Great need of parents to their daughters as labor force
2. Lack of access to educational experts and planners
3. Lack of schools or proper places for girl's education
4. Mixed classes for boys and girls and rural bias on this issue
5. Education expenses
6. Lack of attention to the importance of girls' roles
7. Social, cultural and traditional beliefs about girls
8. Early marriage

Report by UNICEF, claims that literacy rate of women in developing countries is two third of men's, and of about 860 million illiterate adult worldwide, 640 million are women who never had the possibility to go to school or have left school unfinished(Bakhshoodeh and Salami, 2005).

##### **2- Social and cultural barriers**

Sociologically, women in third world countries- especially in rural areas- believe to be dependent on men.

The thought is deeply attached to their historical beliefs. Thereupon they never share ideas while decision-making or planning. As some sociology and politic experts stated, it's the reason they have developed "the silence culture" and they never let themselves to comment on, or participate in planning.

In addition, customs and prejudices that they have been trained with, indirectly affects women's participation. Such ideology of knowing a sex to be lower than the

other is a crippling disease that causes a big part of mental and power sources of community remain disadvantaged. These are all prejudice emphasizing on men's value and denying those of women (Changizi Ashtiani, 2003).

##### **3- Structural barriers**

In fact, in most countries, governing power, marketing and production conditions and some values related to them, create serious structural barriers to women's participation. According to United Nations' research institute of second development program, these structures are anti-participation; because they lead to unequal access to the control of wealth and social status. They cause failure of many national-regional innovations encouraging participation, and finally make a small group be responsible for everything and we won't have the beneficial results associated with women's participation. The structure determines the conditions of participation and reacts strongly to any renovation. Its objective is to keep women in their position as a labor. Labor market divides the jobs in workshops and factories in a way that some occupational fields are only for women and some other only for men. Men are chosen to be the administrator in all professions and it's assumed that women are not interested in or not able to handle these positions. Thus, in practice the world of production and work is subject to gender discrimination.

##### **4- Political and organizational barriers**

In third world countries, women face with many obstacles for participation in decision making, planning, implementation, and evaluation of projects related to country's developing plans. Although, the structure of the country play an important role in making suitable conditions for participation in different areas, but because they have focused plans and such decisions are made by public organizations and official systems, usually the potential force of participation in society will be palled and in practice, participation will face serious obstacles and problems. A focused government always encourages focused official structures. Such a structure is a major barrier to women's participation. They control structures and systems resource allocation and information and knowledge people need to participate in social activities, besides they never let people and especially women control all these. So it's apparent that such programs are either not comprehensive or it's facing problems because designers are not aware of the realities in their community.

##### **5- Barriers related to wife-mother role**

UNICEF reports indicate that women's work hours is 25% longer than men's; because a large number of them work at home to produce livelihood products without payment.

The main role of all women in each society is the role of mother and wife; therefore every other matter such as their employment is subject to these roles. Possibility of finding a job (as administrator or in a lower rank) for a girl is affected by various factors including educational level and their socialization method as a child. They have always been thought that they are not identical to boys in terms of social privileges or social status. Emphasize on the roles of mother and wife may make women think there is no need to promote their social status and in the other hand society will not provide necessary facilities for their development. In this situation they are prevented from studying and schooling. This issue will still be a problem after they are married. It should be noted that with women getting paid, total household's welfare improves; because field studies claim that all women earning money, spend their income on their family and particularly children's needs.

So we should mention that not only participation is a woman's civil right but also it will make her more autonomic, and she'll become more creative and innovative.

#### **6- Economical barriers**

One of the factors indicating development progress is how and how much different classes of society participate in vital activities. Although importance of women's participation has always been completely apparent, the appropriate balance between men and women in different fields is not yet established in our country. As women can only possess a limited sort of jobs and also they always have the smaller share of each job opportunity, they are not able to compete in labor market. What's more, mostly they do not own the capital needed for economical participation, so providing personal credits can solve their problem in some extent.

#### **Discussion and conclusion:**

Supplying credits and analyzing credits approaches cause opportunity to activate poor men's working power, establishing field for sustainable production and income, prevent usurers and pre shoppers of agriculture productions to plunder poor rural men and finally empowering poor people especially women who can work but were deprived to have capital and work tools, and extension accordance to their activities such as needs assessment, identifying target group, organizing poor people, giving needed

specialized and public training and ... have important role on effectiveness and make effective activities of these credits.

Woroniuk, Schalkwyk (1998) at their conducted research believe that now, micro credits, micro finance sources and small business unites are most effective mechanism to decrease poverty.

Plitt and others, conducted research as they called it "do credits programs, can empower women"? Results showed that corporation at credits programs helps empowering women.

Goetz, Sengupta (2003), presented negative image of credits effects on empowering women. They concluded that most women have minimum control on their loans. And when repayment period is short, this shortage of control has devastating effects on women welfare.

Hashemi and others (2004) found that joining to Grameen Bank, has meaningful positive affects on controlling women, and helps to family income.

In researches that conducted by Nanda (2004) became clear that women participation in credits programs had positive affects on their demand about health care.

Fiona Steele and et al (2008) in researches that conducted as called "influences of credits programs on empowering women at Bangladesh", found that women who joined to credits programs, have participated in more educational programs and have married with more educated men and also they have saved more and they had more cash.

Ellen and her colleagues (2009) used approach called it "credits and education at Bolivia, Ghana, Honduras, Mali and Thailand". This approach looks for empowering women through financial services with education. In this approach, women get familiar with importance of credits through education and extension and also familiar with ways to access it through establishing different groups.

Shahnaj and Chaudhury (2009) in research as "credits and its role on empowering women" concluded that there is meaningful relation between attending in credits programs and empowering women, at economical dimensions.

Ruhail Amin and others (2010) found that those who joined credit funds had more ability rather than those who didn't.

Jameela (2010) presented that credit programs has shown lot of affects on empowering women so that has increased their social, politic and economic ability.

Thus it is obvious that credits programs and its educational and empowering programs can be affective on social, humane and economic development or rural society, if it be associated with proper and gradual practices and base on reciprocal

communications principles and apply opinion of local society.

Maybe the main challenges that threaten credits associations , is lack of necessary emphasizes on social dimensions and on reinforcing their basics , that practically cause that this social foundations lose its efficiency soon and practically changed to unsuccessful institution .

In order to overcoming dominant consideration, experts believe that we should consider following in protection process of these social institutions.

- establishing and reinforcing through supporting without ant direct government involvement
- evaluating and constant modifying of financial management mechanisms
- improving organization effectiveness
- establishing constant relation and interaction with similar and equal systems.
- establishing local , regional and national networks
- establishing support and cover systems in order to decrease risk
- establishing balance and interaction with financial systems greater decision making include: capital market (local, regional, national) and governmental.

also following suggestions have been offered:

- helping to marketing and establishing many exhibitions for member's productions, credit programs, guiding and training them in line with group and workshop activity, can assist them on economic empowerment.
- since women have pointed to education deficiency as major barrier for empowering them , thus educating rural women at the field of exploiting different credits and channels of receiving credits , and also various educations , is so that lead to enabling them , that contain considerable importance.
- providing extension educations for men in order to believe economic role of their women , and give them chance of corporation on all economic , credits fields
- Since that base of credit association, forms base on People Corporation, so it's good chance to use these communities to expand extension-education activities. so it is better to consider special programs on different

extensional filed such as agriculture , ranching , family health , housekeeping economy and other fields accordance to condition of region and rural women's needs .

- it is suggested that vast and exact programming happens at following fields:
  - a- extending insurance, facilities for amenities
  - b- educating women about awareness of their own individual and social rights
  - c- persuading rural women about importance of participating at cooperatives and other educational institutes
  - d- educating women about job management and income management

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3/24/2011

## A Simulation Investigation on Impacts of Transportation Disruption for Vendor Managed Inventory Model and Traditional Inventory System

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**Abstract:** Nowadays, Supply Chain Management (SCM) becomes an important issue and involves managing integrated information about product flow, improving efficiencies. One of the important issues of SC is implementing close coordination and relationship among its members. This paper considers two different approach of inventory management which called Traditional Inventory Management (TIM) and Vendor Managed Inventory (VMI) and propose a simulation method to observe the impacts on system efficiency and average inventory level while a transportation disruption situation happened through supply chain comparing with a normal situation. The stimulated members of SC are such as Distributor and Manufacturer. The model supposed that Manufacturer as a producer member has two separate warehouses which called here Raw Material and Product inventories. The models were simulated for 34 months (12,000 hours) by five times replications. Likewise, a disruption is supposed about two months thorough transportation on supply chains. The results show that the reduction of efficiency for TIM model was 17% while for VMI it was obtained by 12% when the disruption occurred in SC. In this context, it can be concluded that VMI is less sensitive when disruption happened and TIM is more vulnerable rather than VMI. The reason belong to this result is due to a great information sharing through all supply chain members. Furthermore, the fluctuation of average inventory level occurred much more on TIM rather than VMI. In proposed VMI model, manufacturer inventory (Product) experienced the largest fluctuation in its average inventory level and it is the most sensitive partner while disruption occurred. However, distributor member in TIM experienced the largest fluctuation in its average inventory level, therefore, it is the most sensitive member towards transportation disruption.

[Afsaneh Noori Houshyar, Soroush Avakh Darestani, Azadeh Noori Hoshyar, Muriati Mukhtar, Riza Sulaiman. **A Simulation Investigation on Impacts of Transportation Disruption for Vendor Managed Inventory Model and Traditional Inventory System**. Journal of American Science 2011;7(4):115-133]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Keywords:** Vendor Managed Inventory (VMI), Supply Chain (SC), Electronic Data Interchange (EDI), Simulation, Traditional Inventory Model (TIM), Transportation Disruption.

### 1. Introduction

Supply chain (SC) is described as a system whose constituent parts include material suppliers, production facilities, distribution services and customers linked together via the feed forward flow of materials and the feedback flow of information (Stevens 1989). During these years Supply Chain Management (SCM) becomes an important issue. SCM involves managing integrated information about product flow, improving customer satisfaction and reducing cost of inventories (Parmar 2007). Although storing inventory has lot of advantages for SC member, it is important to be careful about the level of inventory which must be stocked. Nowadays, managers attempt to store the stock down as long as they are able to meet their customer satisfaction. Reducing inventory level without affecting the availability of product is one of the essential goals in

SCM (Chopra and Meindl 2001). In addition, another important issue in SC is implementing close coordination and relationship among its members. For this mean information sharing is employed which leads to have successful SC. Information sharing increases the chain's visibility and is used for coordinating the material flow (Soroor, Tarokh, and Shemshadi 2009). Based on the research of Cachon and Fisher (2000), the benefits of information sharing along the SC become obvious. Yao and Dresner (2007) concluded that information sharing in SC can reduce safety stock, thereby the average inventory level is reduced.

Moreover, As Centre for Research on the Epidemiology of Disasters observed the disasters have increased exponentially worldwide over the past decades, therefore, SC becomes more vulnerable to disruption (Parmer, 2007). Unexpected disruption in



SC makes negative effects on chain's performance, hence, considering the probability of risk in chain become important. The terrorist attacks on 11 September 2001, the SARS epidemic in South-East Asia, the recent H1N1 epidemic that plagued the whole world and the most current Haiti earthquake are examples of risks which are faced by SC. By considering these happening during previous decade a lot of attentions goes to SC disruption and its management.

By considering the importance of inventory management policies, information sharing and disruption in SC, this research investigates on these issues. According to above, this research has attempted to propose two SC model based on combination of information sharing and inventory management policies. It should not be forgotten to say that the proposed model is strategized by "Make to Order" policy. The models are called Traditional Inventory Model (TIM) and Vendor Managed Inventory (VMI). The VMI is supposed based on information sharing and maintaining the inventory on a min level. However, the policy of inventory in traditional model is considered on max inventory without any information sharing tools. Then

simulation modeling is employed in order to evaluate impacts of transportation disruption on system efficiency and average inventory level as defined KPIs of this paper. The aim of this investigation is to determine the vulnerable model and member in given SC for having a proactive planning.

## 2. Disruption in Supply Chain

In recent years, it can be seen that SCs are prone to disruptions. These disruptions occurred because of natural disasters like earthquakes or tsunamis or it can be because of human activities like the occurrence of wars and embargos. The high regard that manager and firms are paying to disruption is triggered by the frequency and intensity of catastrophes, disasters and crises that have increased in the global scale (Coleman, 2006, Helferich and Cook, 2002). As Figure 1 shows both natural and man-made disasters have increased exponentially worldwide during the past decades (Centre for Research on the Epidemiology of Disasters, 2004). Therefore, SCs become more vulnerable to disruption during these years (Christopher and Peck 2004).

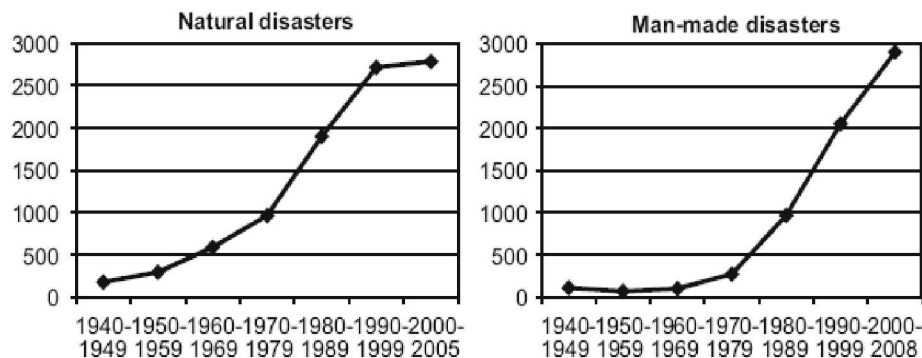


Figure 1. Distribution of natural and man-made over time  
(Centre for Research on the Epidemiology of Disasters, 2004)

G. Zsidisin (2007) reported that unnatural disasters such as war, terrorism, sabotage and natural disasters like tsunamis, floods, earthquakes and health disasters which contains SARS, avian flu and SC infrastructure such as inbound and outbound shipping, manufacturing facilities and overall logistic system are the major sources of disruption in SC. Industries are affected differently by SC disruption (Hendrik and Singhal 2005). The automotive industry has the highest vulnerability towards the disruptions among the industries, (Hannon 2008; Wagner and Neshat 2009). For instance, the disruption which happened in the chain of Robert Bosch GmbH, the world largest auto-parts supplier in January 2005 leads to negative effects on financial status and brand image of Bosch (Wagner and Neshat 2009).

Based on benchmarking which was done by Aberdeen group (2006) 80% of the firms reported that they experienced disruption during the previous months. They added this disruption negatively impacted on their sale, earning, customer satisfaction and brand of them. Although, 62% of the supply chains expect disruption and risk in near future, just around 49% of them try to have risk management plan for mitigating the negative effects of disruption (Aberdeen Group, 2007). The lack of strategic planning and action gap towards disruption are

the main problem of companies in period of disruption, therefore, having proactive planning and preview towards these issues are essential for facing to disruption (Connaughton, 2007, Parmar 2007). Although there are various researches that investigated the types and impact of disruption in a SC, there has been less attention on transportation disruption which can quickly cripple the entire SC and also there exists evidence of several shortcomings in this area (Wilson, 2007, Kleindorfer and Sudd, 2005). Transportation disruption leads to making delay or stoppage in goods flow and also goods production. Actually it arises when the material flow is faced problem between two echelons in supply chain (Chopra and Sodhi 2004). For instance the terrorist attack to Pentagon in 2001 lead to stoppage of many assembly lines of Ford just because of delayed at Canadian and Mexican border which had happened following of attack (Sheffi, 2001). Table 1 has summarized literature review of related issues in this research.

Table1. Summary of literature review

Authors	year	Scope of research
Kleinder and Sadd investigation.	2005	Disruption in SC has not widely studied, it needs more
Martha C. Wilson	2007	In order to mitigate the negative effects of SC disruption, it is important to have early investigation on this issue. Also he added that transportation disruption as subset of disruption resources received less attention than other disruption in SC. He investigates on transportation disruption in push SC and also the defined transportation disruption was between each two echelons separately.
Christopher and Lee/Lee and Walfe/Rice and Caniato/Staar, Newfrock, and Delurey/Sheffi and Rice/Tang 2001/2003/2003/2 003/2005/2006. They Have different recommendation for successful uncertainty managing uncertainty managing		
Data and Christopher	2010	He showed the value of information sharing and coordination between the chain's members in order to managing the uncertainty in SC by focusing on push system or "make to stock". He illustrates that there is need to investigate on combination of recommendation for having a successful uncertainty managing They Have different recommendation for successful
Li and Wang 2007 He explained that previous researches did not find an effective mechanism for encountering the uncertainty and disruption.		
Parmer 2007 The action gap towards the disruption is the greatest weakness of supply chain. The early warning system is necessary for mitigating the SC disruption.		
Connaughton 2007 Having proactive planning and preview to disruption and effects of that are essential		
Giunipero and Eltantawy 2004 The research which has done on the area of transportation disruption is so general and cannot cover the strategy for mitigating the effects of that.		
Chen et al. /Lee / Lee, Padmanabhan, and Whang / Lee and Billington /Levy / Stermann and John/ Cachon/ Zsidisin 2000/2002/1997/1992/1995/1989/2004/2003		
They show importance role of information sharing, electronic data interchange, collaboration planning, replenishment, for mitigating the negative effects of disruption in SC.		

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He illustrate that there are lots of researches which have been published on coordination among chain but there are little works that explicitly take uncertainty into account.

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Tyan, Wang and Du 2003 As “Make to Order” bring more advantages for firms rather than “make to stock”, therefore, most of the firms are interested to replace it.

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Ting and Khoo 2007 He explained that there are lots of researches which have been done on the area of push system of SC but there is just few on pull strategy.

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Gunasekaran and Nagai	2005	“Make To Order” strategy becomes popular after its successful implementation by Dell and Compaq in Pc industry, it must still implement in the other high value industries like automobile that need to be flexible to their customers need. He explained that there is need to investigate more on new strategy of “Make to Order”, especially in designing and controlling “Make to Order” supply chain.
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Gonkar and Viswanadham/  
Kouvelis, Chambers and Wang / Hendricks and Singhal 2003/2006/ 2005 Investigated on safety mechanism for protecting the SC and reducing negative and costly effects of disruption is essential.

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2005 Studied disruption stage and provide recommendations for having flexible SC.

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Yusef et al. 2004 Found that information integration and high degree of coordination between the chain's members are useful factors for agility of supply chain.

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2008 Developed a framework for global supply chain risk management.

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Christopher and Lee/ Blackhurst et al.  
2004/2005 Having more visibility and capacity management are helpful in managing and reducing the chain's risk.

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Tang/ Kouvelis, Chambers and Wang  
2006/2006 There is need to have more investigation on supply chain risk management issue.

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Kleindorfer and Saad / Christopher and Lee/ Lee and Walfe /Rice and Caniato  
/Staer, Newfrock, and Delurey/ Sheffi and Rice / Tang  
2005/2001/2003/2003/  
2003/2005/2006  
Provided different recommendation for successful uncertainty managing.

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Data and Christopher	2010	There is need to have more investigation on the effects of different practices which have been recommended by previous researcher and assess the system performance under uncertainty and disruption for combination of these recommended practices.
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Based on table1, importances of this research are revealed as:

First of all there are limited researches in the area of determining the vulnerability of supply chains which have different structures and also identifying the sensitive members to disruption in a given supply chain (Wilson, 2007, Kleindorfer and Sadd 2005) . Secondly previous researches investigated transportation disruption between two echelons in a supply chain (Wilson, 2007) and not the whole supply chain as will be the case when disasters such as big floods or earthquakes occur. Thirdly, most of the work on supply chain disruption has

focused on “Make to Stock” or push supply chains as opposed to pull supply chains which are getting more prevalent now. Also, Datta and Christopher (2010) focused on “Make to Stock” strategy and proposed “Make to Order” or pull SC as future research to evaluate the combined effects of information sharing and coordination among chain’s members for managing uncertainty.

### 3. Material and Method

As mentioned previously, this paper has investigated on two different points of views toward SC for information sharing and inventory managing. The first one is Traditional Inventory Model (TIM) and the second one is Vendor Managed Inventory (VMI). The first model (TIM) has no information sharing along its chain and it is based on inventory management in pull based SC but the second model (VMI) contains information sharing among the whole members of pull based SC and also it contains close co-operation for its inventory managing. Therefore this investigation firstly, proposes two models, and then based on importance of transportation disruption, the models were simulated for 12,000 hours in two statuses which are normal situation and disrupted situation. The aim of this investigation is to analyze the impact of transportation disruption on both proposed models and to identify which model has higher performance under transportation disruption situation and also to identify the sensitive member of SC. For this mean system efficiency and average inventor level are defined as two KPIs of this research.

To have a better overview from the proposed SC for this research, authors depicted the chins, member and the flow or supply on the material and the product in Figure 2. In the following sections the TIM and VMI will be explained by detail.

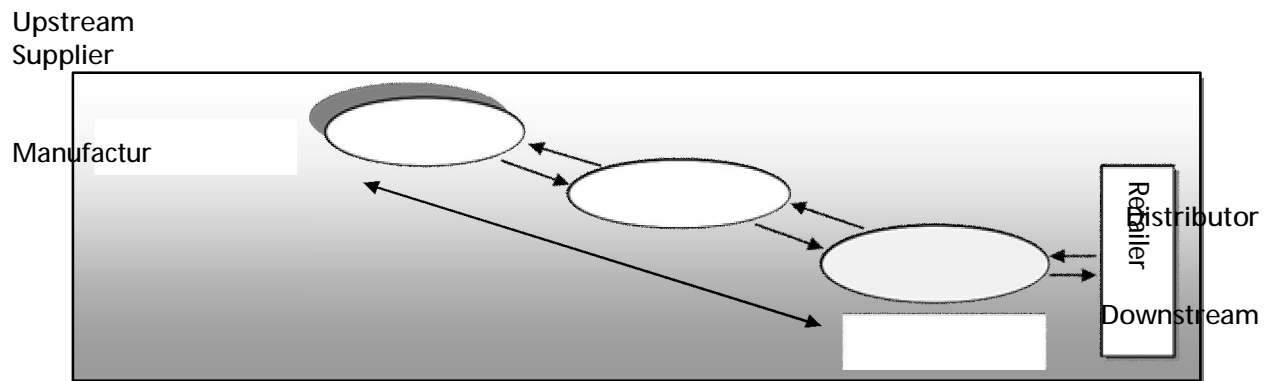


Figure2. Proposed supply chain model for this research

#### Ø Proposed Traditional Inventory Model (TIM) for Supply Chain:

There is no information sharing among the chain’s member in this model, therefore, upstream members use replenishment information from immediate downstream member to respond incoming orders. The information directly is sent by the downstream member to upstream partner of chain based on the coming orders. Demand from the downstream partner leads to shipments of goods and pull the products from the upstream member in supply chain. In this model which will be explained by details further, each member of chain is responsible for its inventory managing and replenishing. Based on “Make to Order” strategy which is employed in TIM, the production is not started in the system until the retailer’s order comes to the system, when the retailer’s order comes to the system, the system will start its production based on the retailer’s requirement, therefore, the retailer will be satisfied because they receive the product with the exact specification which they defined. On the other hand, in this model, the material flow is triggered when the downstream member pulls the material from its upstream partner. Furthermore, in TIM, the max inventory replenishment is proposed for each member by evaluating its own inventory level. Based on this inventory policy, while remained inventory at each echelon of chain meets Re-Order Point (ROP) level, the manager place order to fulfill the warehouse and reach the level of inventory to the maximum initial inventory.

As Figure 3 shows, the automobile retailer’s orders come to the system and distributor receives the orders (step1, 2). The orders are checked by distributor either they have sufficient inventory or not (step3). If enough inventories be available, they ship to the retailer. Simultaneously, they update their inventory level and also check the remained inventory level with Re-order Point (ROP) which is defined by Economic Order Quantity (EOQ) model (step7, 8, 9, 10, 11). If remained inventory be more than ROP, there is no need for ordering to

manufacture, otherwise order must be sent to manufacturer (step12, 13). The quantity of this order is equal to the difference of current distributor inventory and the maximum initial level of inventory in distributor. The other statues may be happened if there is no sufficient inventory at distributor hand, therefore, retailer decides whether wait for automobile or leave the system. If retailer decides to wait, orders are sent to manufacturer (step 4, 5, 6). After receiving orders by manufacture, the inventory level of automobile is checked whether they have enough automobile for sending to distributor or no (step14). If they are able to meet the distributor's order, the automobile is loaded and shipped to distributor, then manufacturer inventory level (product) is updated (step15, 16, 17, 18, 19, 20, 21). Otherwise, if manufacturer does not have sufficient inventories, based on the pull based system logic, the production want to be started but before that, the order quantity must be checked with Economic Production Quantity (step22).

Beside the inventory managing definition, Economic Production Quantity (EPQ) is an important issue in producing company. Economic Production Quantity is defined for optimizing cost and number of production. On the other hand, the function of this model is to balance the inventory holding cost and the ordering cost. Economic Production Quantity is defined based on the strategy, long term planning and demand of company. When the order quantity be less than EPQ, production is not started, it will wait until the other orders come and production quantity becomes equal or more than EPQ. If manufacturer concludes that the number of incoming order is economic for production, the number of production is calculated and then checked by manufacturer inventory (Raw material) (step 23, 24, 25). By sufficient raw materials, manufacturer start its production, otherwise it must wait for replenishing the raw materials by supplier (step 26, 36). After finishing production process, the inventory level of manufacturer (product) is updated (step 27). According to quantity of incoming orders, the produced automobile is sent to distributor. By each deduction of raw material at manufacturer level, remained inventory is checked by ROP for clarifying whether it needs to place order or no (step 28, 29). If manufacturer face shortage of raw material, the order is sent to supplier and supplier respond to manufacturer's requirement (step 30, 31, 32, 33, 34).

### **Step1** **Retailer Arrival**

### **Step2**

**Receiving the orders by Distributor**

Yes

### **Step4**

**Retailer wait or leave the system?**

### **Step3**

NO

**Automobile  
available is enough?**

Yes

### **Step7**

**Update Distributor Inventory**

NO

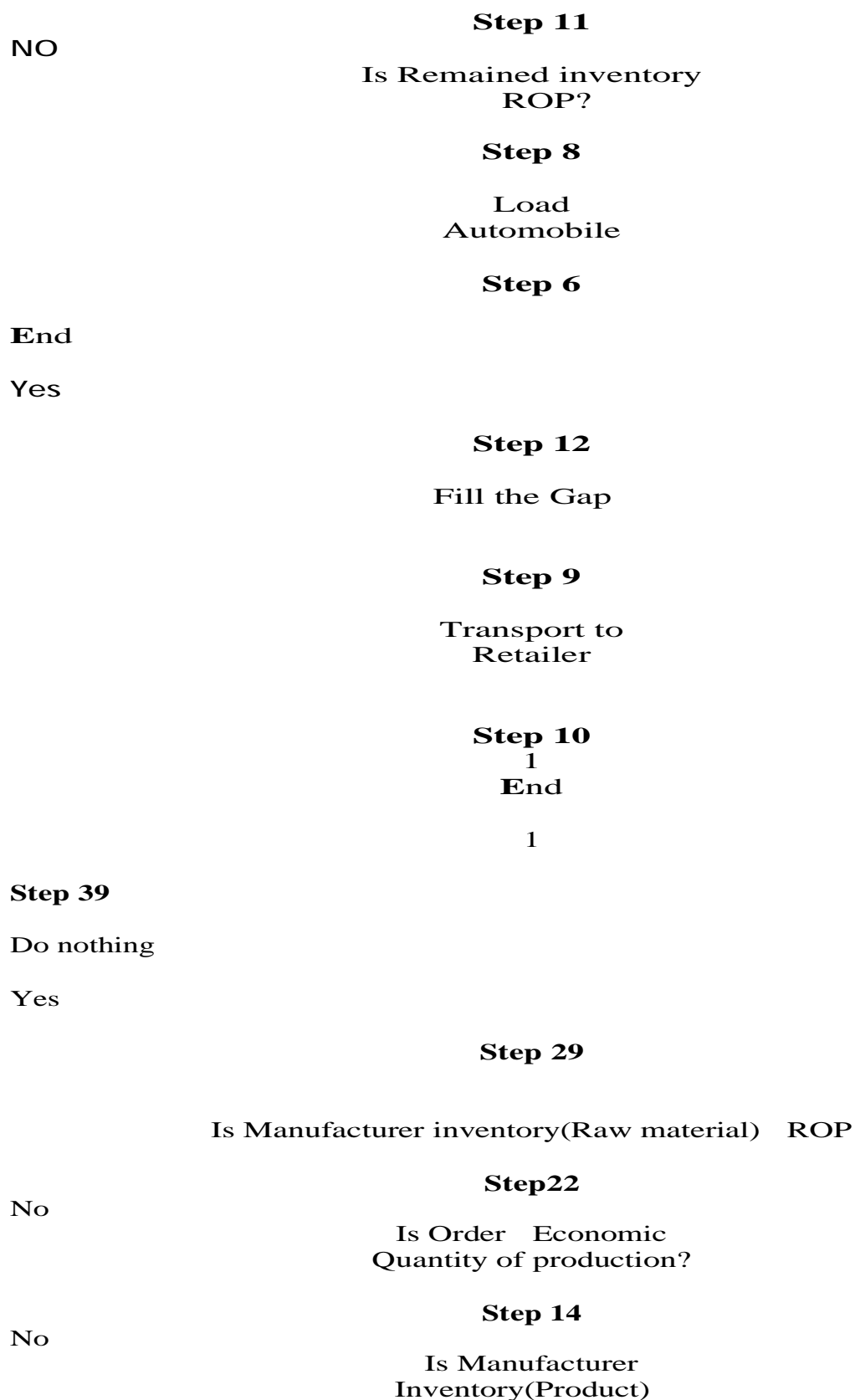
### **Step5**

**Retailer leave the system**

### **Step13**

**Do Nothing**





Order?

Yes

**Step 15**

Update Manufacturer Inventory(Product)

No  
Yes

**Step 30**

Order to supplier

**Step 23**

Calculate lead time

**Step 16**

Load the  
Automobiles

**Step 31**

Supplier receive the orders and batch the material

**Step 32**

Update the raw material

**Step 33**

Transport to  
Manufacturer

**Step 36**

Order to supplier

**Step 37**

Supplier receive the orders and batch the material

**Step 38**

Update the  
Raw material

**Step 24**

Calculate No of Production

**Step 25**

Yes

```

graph TD
    Start(( )) --> D1{ }
    D1 --> S34[Step 34]
    S34 --> S35[Step 35]
    S35 --> End1[End]
    D1 --> R[Receiving by Manufacturer and unbatching]
    R --> P1[ ]
    P1 --> P2[ ]
    P2 --> P3[Update the Manufacturer inventory (Raw material)]
    P3 --> D2{ }
    D2 --> P4[ ]
    P4 --> P5[Update Manufacturer inventory (Product)]
    P5 --> D3{ }
    D3 --> P6[Update the Distributor inventory]
    P6 --> S21[Step 21]
    S21 --> End2[End]
    D3 --> S28[Step 28]
    S28 --> D4{ }
    D4 --> S34
    D4 --> S35
  
```

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### Ø **Proposed Vendor Managed Inventory (VMI) Model for Supply Chain**

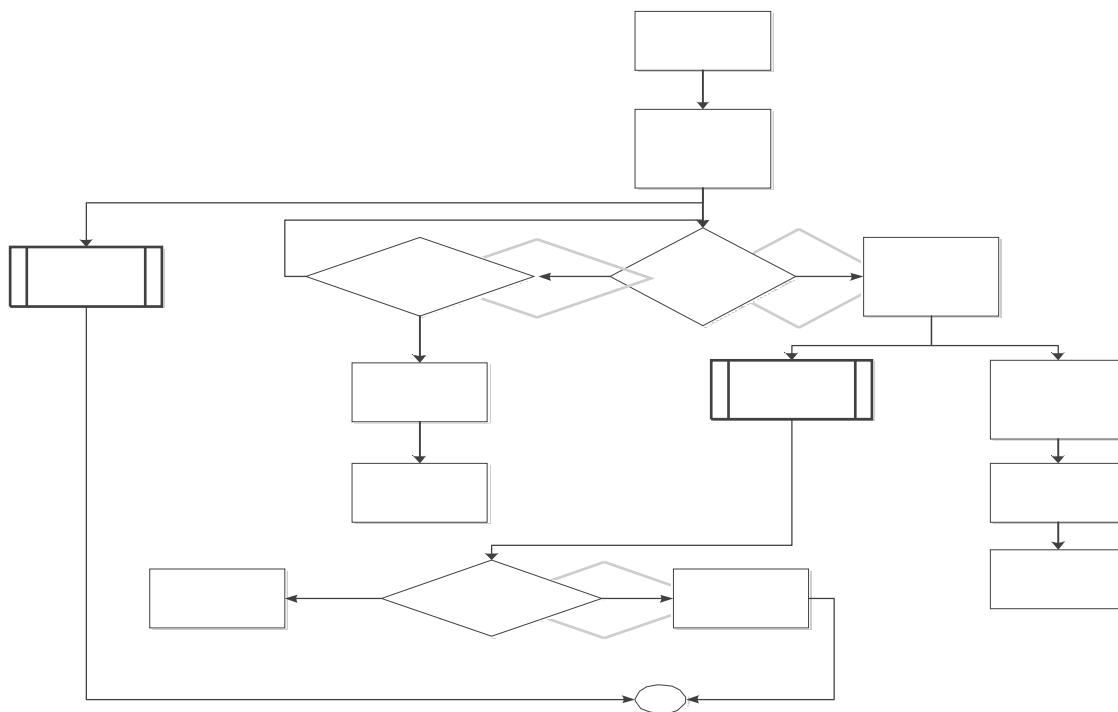
In proposed VMI model of this investigation the information is shared between all members of chain in contrast with previous models which shares information just between two members of chain. The information is shared via the EDI among the whole members of chain. Based on the shared information, each member is responsible for managing and replenishing of its downstream partner's inventory. On the other hand, the main feature of VMI is inventory managing of customer by its vendor, in the proposed VMI model, this inventory managing responsibility which is done by vendor has been defined during the whole chain and between the whole members of SC. In contrast, the previous VMI models just defined this responsibility between two echelons of SC. Therefore, this proposed VMI model contains the information sharing and also the inventory managing by vendor along the whole chain and between the whole members. Furthermore, to design the proposed VMI model of this research, maintaining ROP inventory level was employed for its inventory managing policy. This strategy is used by each upstream member of SC for deciding whether needs to replenish inventory, fulfill the gap and increase the inventory to the ROP level and try to keep it at that level.

Figure 4 depicts, in VMI scenario, retailer's order come to the chain and is checked by distributor (step1, 2). Simultaneously, they share retailer's demand data with manufacturer via the EDI (step3). The inventory level of distributor may be enough for responding to retailer's order or may not (step4). If distributor does not have enough automobile inventories, retailer decides whether wait or leave the system (step5). If the available inventory is sufficient, distributor ship the automobiles to retailers and then, inventory updating is done (step 8, 9, 10, 11). Also, they use EDI to inform manufacturer the current level of their inventory (step12).

Based on the information which has shared by EDI, manufacturer control the distributor inventory, decide when and what quantity is needed to send automobile for distributor (step13). The main difference between the proposed traditional and VMI model is on information sharing which exists in VMI and leads to better collaboration between the chain's members. Moreover, inventory managing is done by upstream member of chain for downstream in VMI. Based on mentioned differences between the proposed VMI and traditional model, after the automobile shipment to retailer, manufacturer control the inventory level of distributor (step13). This control is done for preventing the shortage of automobile in distributor level. If manufacturer perceives that inventory level of distributor fall down the Reorder Point (ROP), they decide to provide and send automobile to distributor (step13, 15). Manufacturer checks their own inventories, if sufficient automobile be available, they send to distributor (step16, 17). Otherwise they decide to produce automobile based on distributor's requirement. If the number of order be more than , then lead time and quantity of production are defined (step24, 25, 26). In this part, manufacturer transfer the production planning to supplier via EDI (step27). As mentioned above, one of the most important attribute of proposed VMI is responsibility of upstream members towards downstream members for inventory managing. For this reason, at the same time supplier check raw material inventory level of manufacturer based on the production planning which is shared by manufacturer via the EDI, and then make decision when and what quantity of raw material they must send to manufacturer (step28). If supplier observations show that the inventory level of raw material in manufacturer is sufficient for production, manufacturer be aware of this and start their production (step32). Otherwise, supplier prepares the quantity of raw material which is needed by manufacturer, then ship it to them (step29, 30, 31). The inventory level of both raw material and finished product are updated after each deduction or increment (step30, 34). Also, after each deduction from raw material, manufacturer use EDI to share the inventory level of raw material with the supplier (step35). Supplier uses this shared information for checking the inventory level with ROP and decides whether it is needed to send raw material to manufacturer or no (step36).

To sum up, in the proposed VMI structure, the downstream member of chain allows the upstream member to be aware of demand information and inventory level via the EDI. Upstream member uses this information for their planning. In proposed VMI model, maintaining ROP inventory was employed when the inventory fall down the re-order point. The order quantity in proposed VMI model is calculated by downstream requirement plus ROP inventory level.

Figure 4 shows the proposed VMI model for SC as follows:



### Step 1

## Step2

### Step 3

EDI(1) to

Yes

### Step 5

### Retailer wait or leave the system?

### Step 4

No

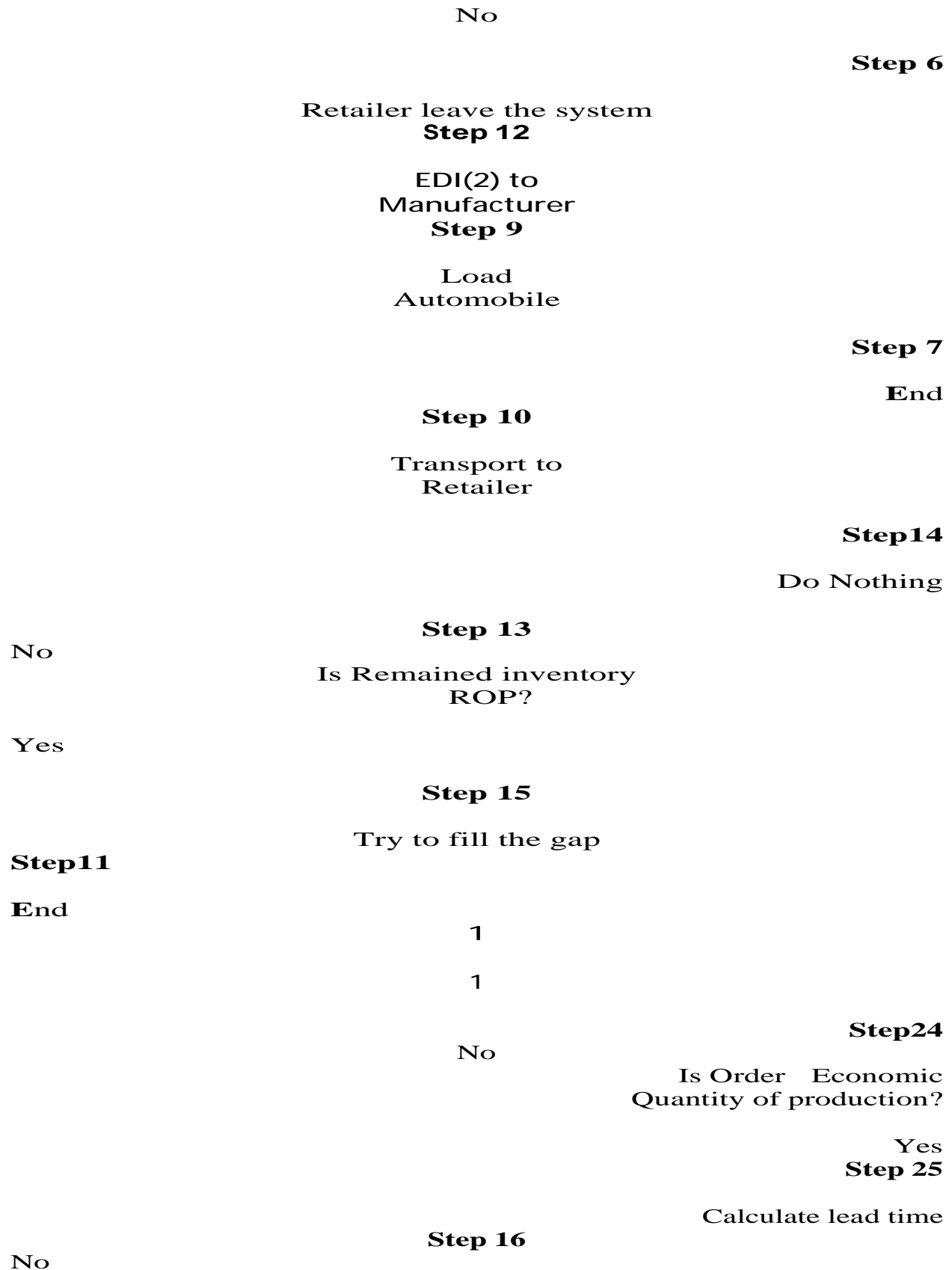
Automobile available is enough?

Yes

### Step 8

## Update Distributor Inventory





Is Manufacturer  
Inventory(Product)  
Order?

Yes

**Step 17**

Update Manufacturer Inventory(Product)

**Step 18**

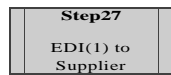
Load the  
Automobiles

**Step 26**

of Production

**Step19**

Transport to  
Distributor



**Step 20**

Receiving by  
Distributor

**Step 29**

Matching by  
Supplier

No

**Step 28**

Is Raw material

No of production?

Yes

**Step 32**

Start producing

**Step 21**

Unload the  
Automobiles

**Step 30**

Update the Raw material inventory

**Step31**

Transport to  
Manufacturer

**Step 34**

Update the Manufacturer inventory (Raw material)

**Step35**

EDI(2) to Supplier

**Step 33**

Update Manufacturer inventory (Product)

**Step 22**

Update the Distributor inventory

**Step 23**

End

**Step 37**

Do nothing

**Step 36**

Yes No  
Is Manufacturer  
inventory(Raw material)  
ROP  
**Step 38**

Batching by  
Supplier  
**Step 39**

Transport to  
Manufacturer  
**Step 40**

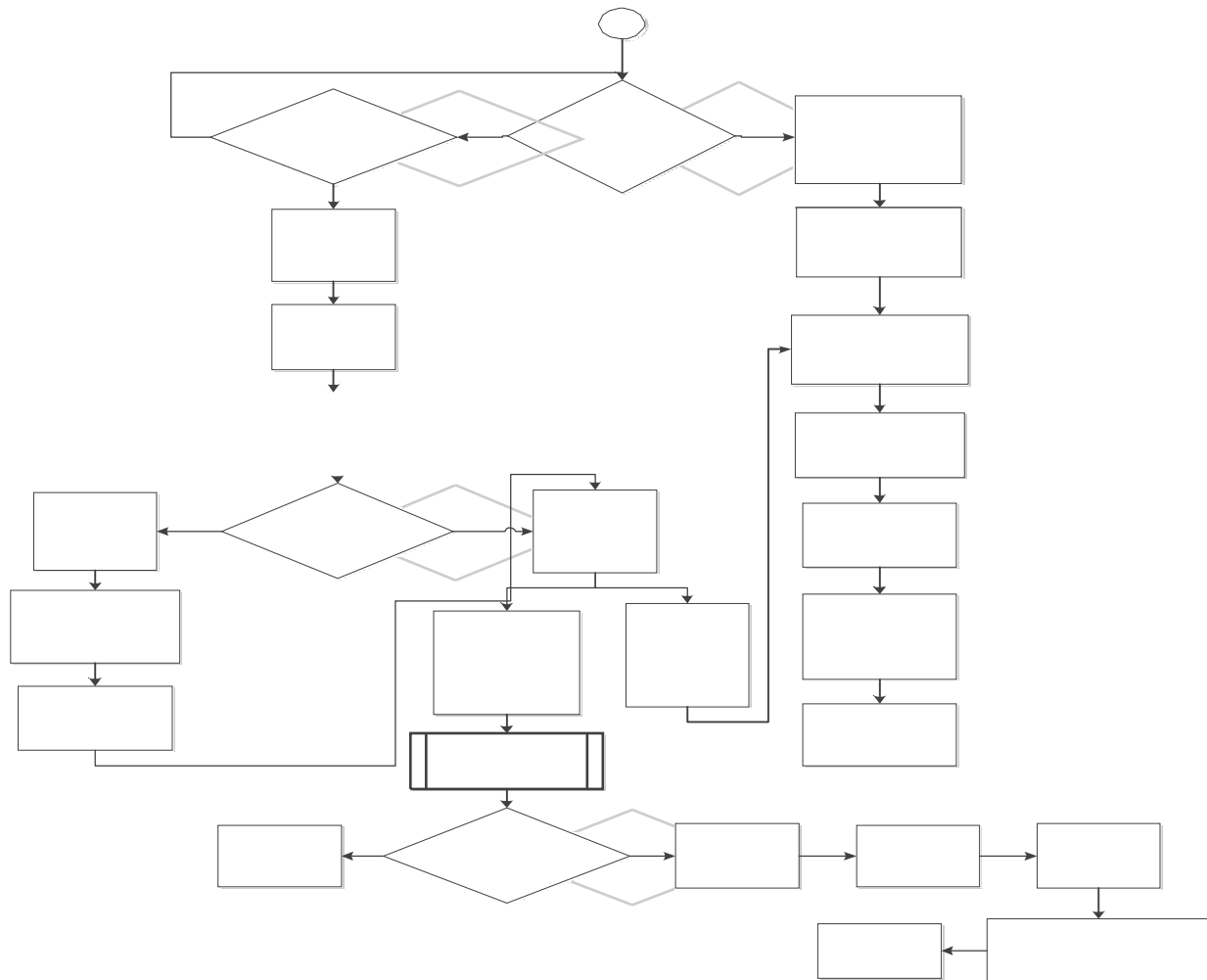
Update the raw material

**Step 42**

End

**Step 41**

Receiving by Manufacturer and unbatching



#### 4. Result and Discussion

To simulate the model for this investigation, Arena software (version 13) has been applied as the powerful simulation software for simulation researches. Both proposed models are simulated five times over a time period of 12,000 hours by the warm up period of 500 hours. Since this research investigates on effects of transportation disruption, hence, each model is run under two conditions; normal situation and transportation disrupted situation. In the normal situation, the transportation time between the members is assumed 16 hours but in disrupted situation, when the problem happens in the system, it leads to delay in transportation along the chain, therefore, the transportation time increases to 64 hours. The disruption must occur after the warm-up period in simulation running for ensuring that the system's behavior is steady and the obtained results are accurate (Wilson, 2007). Therefore, the disruption happens in the 1760th hour in the system and takes 700 hour, then the system will work normally again. As this paper investigates on two KPIs which are system efficiency and average inventory level, so that the Arena records the defined KPIs and reports as follows:

- **System Efficiency Percentage**

The system efficiency of proposed models depicts in Table 2. The results illustrate that the efficiency of TIM is 79% for normal situation and when transportation disruption happens among the whole members of chain it decreases to 65%.

Similarly, the efficiency of VMI has decreased from 84% to 74% when the disruption occurs in the system. Therefore, the less reduction in VMI efficiency rather than TIM when disruption happens shows that, VMI model is less sensitive and vulnerable to disruption. On the other hand, TIM is more vulnerable to transportation disruption rather than VMI, because by the information sharing which exists in VMI model, the

unplanned disruption which may occur in SC becomes easier to manage in comparison to TIM.

Table2. Comparison of system efficiency of VMI and TIM

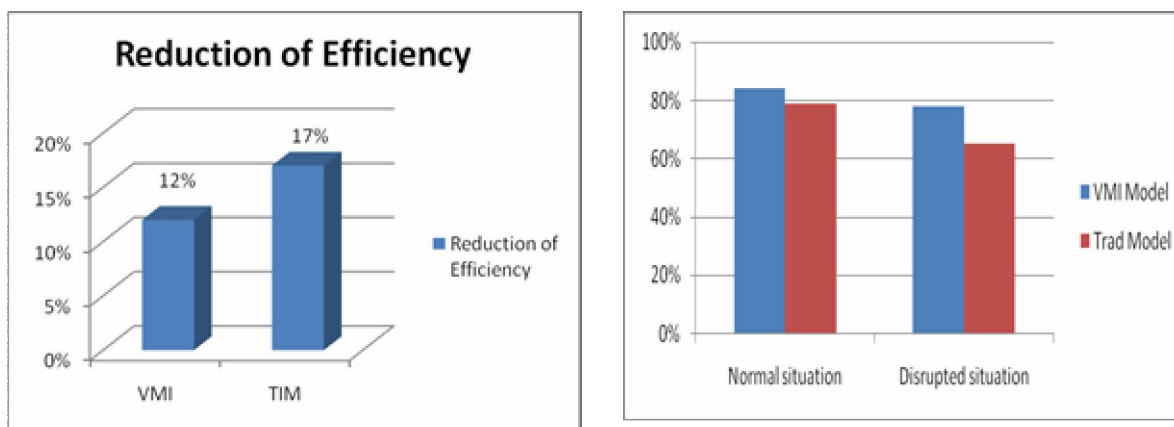
Normal situation

Disrupted situation

Figure6. Reduction of Efficiency on VMI & TIM

VMI 84% 74% TIM 79% 65%

Also, Figure 5 shows that proposed VMI model has greater system efficiency rather than TIM in both normal and disrupted situation, therefore, it has better performance rather than TIM, and also it is less sensitive to disruption.



#### • Average Inventory Level in VMI and TIM

Another KPI of this research is Inventory level. Table 3 shows the inventory level of each member in SC under two identified situations. The inventory levels are obtained from simulation report after five times replications in normal status and disrupted status.

Table3. VMI Simulation Results

Case  
Material)

Manufacturer Inventory Level (Raw

Manufacturer Inventory Level (Product)

Distributor Inventory Level  
Normal situation

2093 1636 542

1993 1532 526

situation

Disrupted

Figure5. Comparison of system efficiency between VMI & TIM



According to Figure 6, in VMI model, the reduction of efficiency while destruction occurred is about 12 % while it is measured 17 % for TIM model. The lower fluctuation in VMI model reveals that VMI is less sensitive rather than TIM model.

Since transportation disruption simultaneously happened in the system between supplier - manufacturer and also manufacturer - distributor, therefore, the level of inventory decreases for two warehouses after disruption. Table 3 represents that the disruption on VMI did not effects much more on the average inventory level of members because, with the information sharing and good co-operation which exists in VMI, the members can mitigate the negative effects of disruption on their inventory level. On the other hand, by information sharing in VMI model, the SC visibility is increased and leads to better inventory managing and planning. In addition, Table 3 shows that in proposed VMI model, the manufacturer inventory (Product) experienced the largest fluctuation in its average inventory level and is the most sensitive partner to disruption. Also, in TIM, s shown in Table 4, distributor experienced the largest fluctuation in its average inventory level and is the most sensitive member to disruption.

In addition, the simulation results for inventory level of TIM's members under two situations of normal and disrupted are shown as Table 4.

Table4. TIM Simulation Results decreases from 2119 to 1980 units, and also the average inventory of manufacturer (Raw material) decreases from 2866 to 2861 units, therefore, the efficiency of system when disruption happens should be decreased accordingly. Indeed, when the disruption happened, the flow of goods face with delay, therefore, it leads to make the problem of lacking inventory for the members. Therefore, in disrupted period, the inventory level of them comes down and after overcome to the disruption the inventory will go up again, therefore, it leads to more fluctuation in average inventory level which is the consequence of information sharing lack.

Case Manufacturer Inventory Level (Raw Material)

Manufacturer Inventory Level (Product) Distributor Inventory Level

However, the result reveals that the average inventory of raw material belongs to manufacturer in VMI has not decreased less than TIM. It is due to Normal situation Disrupted situation

2866	2119	1020
2861	1980	1193

Based on Table 4 when disruption occurs, lack of information sharing with Tier 2 supplier.

Figure7 depicts the comparison between VMI and TIM model for all member average inventories. It can be demonstrated that the average of inventories are lower than TIM model for all warehouses through supply chain the average inventory of manufacturer (Product).

3000

**Line Plot of Mean( VMI, TIM )**

C1

Distributor Inv. (Distruption)

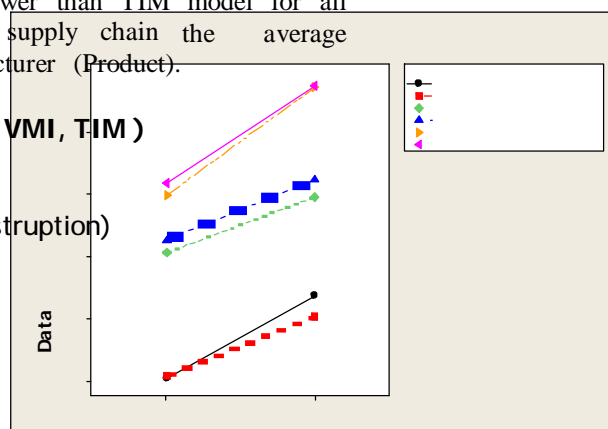
2500

2000

1500

1000

500



- Distributor Inv. (Normal)
- Manufacturer Inv. Product (Distruption)
- Manufacturer Inv. Product (Normal)
- Manufacturer Inv. Raw (Distruption)
- Manufacturer Inv. Raw (Normal) VMI, TIM

Figure7. Glimpse comparisons between VMI & TIM for all members

Figure 8 shows that that average fluctuation for VMI model is less than TIM model when comparison has been taken in account on a average of all inventories warehouses. It can demonstrate that for a whole comparison on all members' inventory level, the reduction of inventory for VMI is 4.66% while for TIM was resulted by 7.86 %.

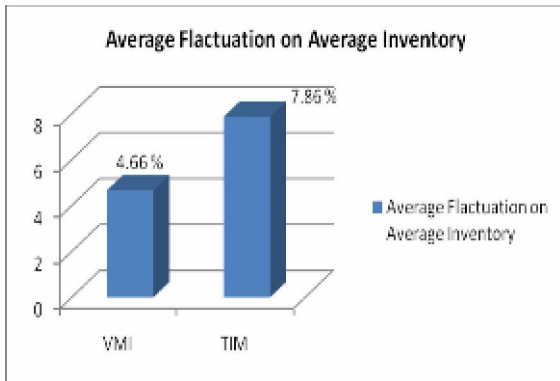


Figure.8: average Fluctuation on Average Inventory for whole chain

## 5. Conclusion

In transportation disrupted situation, there are delays in material and product flow among the chains. It leads to reduction in responded orders and system efficiency for both models but the simulation results indicate that changes in efficiency and inventory level are less for proposed VMI model rather than TIM. Moreover, although both models feel the impacts of transportation disruption on their efficiency and inventory level, the less reduction in system efficiency and inventory level in proposed VMI model in comparison to TIM under transportation disrupted situation indicate that VMI model is less sensitive and vulnerable. Therefore, TIM is more sensitive to transportation disruption. Also, Manufacturer inventory (Product) is most sensitive partner in proposed VMI model and Distributor is most sensitive partner in TIM as they have more fluctuation in their inventory. According to the results, the sensitivity of VMI when disruption occurred is by 12 % while for TIM was obtained by 17 %. It can be concluded that proposed VMI is less vulnerable when disruption occurred.

The differences that make VMI model more efficient than TIM are information sharing and vendor inventory managing system which exists in VMI model, also, coordination among players is a key to success. As far as decision makers are looking for decision support, the results of this investigation can be employed by decision makers for an effective decision. It may help them to decide about implementing VMI in their chains to bring higher

productivity into chain and even less damage and vulnerability in disrupted situation.

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## Electrochemical Degradation of some Pesticides in Agricultural Wastewater

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**Abstract:** This work deals with the possibility of using graphite electrodes for the electro-catalytic oxidation process of some pesticides (malathion, imidacloprid and chlorpyrifos). The graphite electrodes were used in the combined process in the presence of transition metals modified kaolin catalyst. The results of the electrolytic oxidation were expressed in term of chemical oxygen demand (COD) removal, which was determined instrumentally. The highest efficiency of COD removal was obtained in the presence of the transition metals modified kaolin catalyst. The different operating conditions of electro-catalytic oxidation process were studied which include: current density, pH, electrolysis time and initial pesticide concentration. The optimum operating conditions for the above mentioned electrode were determined.

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<http://www.americanscience.org>.

**Key words:** Graphite electrode, electro-catalytic degradation transition metals modified kaolin catalyst, combined electrochemical oxidation, pesticides.

### 1. Introduction:

The ambitious plan of the Government of Egypt (GOE) to reclaim 3-4 million feddans as an additional cultivated area up to the year 2017 put further pressure on the existing limited fresh water resources. On the other hand, the vast increase in industrial horizontal and vertical expansions need more water conservation. Furthermore, the increasing population presents another red flag for the available renewable water resources. According to the limited water availability, there is a real need to search for another water sources. These sources can be found within the non-conventional water sources in Egypt. The agricultural wastewater represents one of the major non-conventional water sources in Egypt due to its volume that reaches about 16 billion cubic meters per year (BCM/yr). Most of this volume, about 12 BCM/yr, is disposed in the Mediterranean Sea. Water quality of this major source is threatened due to several pollution causes. So, chemical treatment of this major source before using is very important [Omran, 2009].

Out of the world production of pesticides (3 million tonnes in 2009), 20% (equivalent to 600 000 tonnes) were exported annually to developing countries, and at least 90% were used in agriculture for pest, weed and plant disease control. The remaining 10% were used for public health programmes, particularly for the control of vectors of human diseases (malaria, filariasis, schistosomiasis, leishmaniasis and trypanosomiasis). The amount of pesticides applied actually affecting target pests is often less than 1%, while over 99% moves into the environment to contaminate the land, water and air.

These toxic compounds have been implicated in various disorders and diseases including cancer, adverse reproductive outcomes, peripheral neuropathies, neurobehavioral disorders, impaired immune functions and allergic sensitization reactions, particularly of the skin, cumulative inhibition of cholinesterase activity because of long-term low doses of exposure [Quraishi and Mageed, 2009].

Millions of tons of pesticides applied annually are used in modern agriculture to increase production through controlling harmful effects caused by the targets organisms including insects, fungi, bacteria, viruses as well as grasses grown in between the economical crops [WHO, 1996].

Polluted drainage water from a dump of toxic chemical waste containing organophosphoric pesticides and their natural degradation products was treated with electrochemical oxidation in order to investigate the applicability of the technique in remediation of natural complex polluted water [Muff et al., 2009].

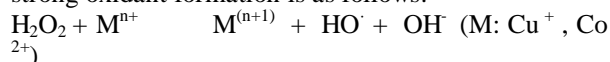
### 2. Experimental:

In this paper the combined electro-catalytic oxidation of pesticides present in agricultural wastewater in the presence of  $\text{Cu}_2\text{O-CoO-PO}_4^{3-}$  modified kaolin was investigated. Two processes are involved in the whole degradation process: catalysts adsorption and synergistic oxidation process. By adsorption process, pollutants can be immediately adsorbed on the catalyst due to its high surface area and porous structure. By combined electrochemical oxidation process, strong oxidants produced through decomposition of electro-generated  $\text{H}_2\text{O}_2$  can destruct

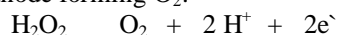
organic pollutants and convert them into  $\text{CO}_2$  and  $\text{H}_2\text{O}$ . Near carbon anode, the evolution of  $\text{O}_2$  with high yields can immediately reduce on porous graphite cathode to form  $\text{H}_2\text{O}_2$ :



In the presence of transition metal modified kaolin, strong oxidant formation is as follows:



This process is similar to the electro-Fenton process. However, in the  $\text{Fe}^{2+}$  existed homogeneous aqueous phase, electro-generated  $\text{H}_2\text{O}_2$  can diffuse onto the anode forming  $\text{O}_2$ :



## Experimental Materials and Methods

1. Preparation of catalyst that is used in an electrolytic batch reactor with graphite electrode:

### 1.1. Catalyst preparation and analysis

The  $\text{Cu}_2\text{O-CoO-PO}_4^{3-}$  modified kaolin (chemical structure of kaolin is  $\text{Al}_2(\text{OH})_4\text{SiO}_5$  which is named as aluminosilicate clay) was prepared as follows: adding 66.6gm  $\text{CuSO}_4$ , 14.2gm  $\text{CoCl}_2$  and 70gm  $\text{K}_3\text{PO}_4 \cdot \text{H}_2\text{O}$  into 250mL distilled water (pH 7.1), 10 mL  $\text{H}_3\text{PO}_4$  was added to dissolve the salts of metal (Cu, Co), then the solution pH was adjusted with NaOH solution to a neutral conditions. Two hundred grams of kaolin powder which was used as support was impregnated into the solution with mechanical stirring in a water bath at  $50^\circ\text{C}$  for 4h. After that, the solution was aged at room temperature for 48h and filtrated, washing, the deposit was dried at  $100^\circ\text{C}$  for 4h. To immobilize the metals, the prepared dried slurry was sent to calcine at  $600^\circ\text{C}$ .

XRD pattern of neat and modified kaolin

The patterns of XRD for the neat kaolin and modified kaolin are shown in Fig.1. Two diffraction peaks that related to kaolinite and muscovite can be clearly observed in Fig.1 (a), the presence of peaks as an attributive indicator of kaolinite and of muscovite is detected. Two common trends can be seen in contrast of Fig.1(a) and (b): first, the intensity of the peaks characteristic of kaolinite decreases at  $600^\circ\text{C}$ , which indicates the stable Al-O octahedron structure in neat kaolin has broken and the losses in crystallinity and the structural deformation. Meanwhile, the characteristic peak for muscovite has been strengthened.

SEM analysis of neat and modified kaolin

The morphology of  $\text{Cu}_2\text{O-CoO-PO}_4^{3-}$  modified kaolin examined by SEM and representative photographs were shown in Fig.2. It can be observed that the previous flaky structure of neat kaolin (see Fig. 2(a)) has changed into granular structure through the

modification process: intercalation of  $\text{Cu}_2\text{O-CoO-PO}_4^{3-}$  into kaolin has resulted in an increase in the stacking disorder of the kaolin. After the modification and calcinations, the layer bonds of neat kaolin are broken, which lead to more micro-sized particles and pored structure (seen in Fig.2 (b)) has formed. This was consistent with the results of that the enlarged BTE surface of modified kaolin ( $38\text{m}^2\text{g}^{-1}$ ) compared with the neat kaolin ( $2038\text{m}^2\text{g}^{-1}$ ).

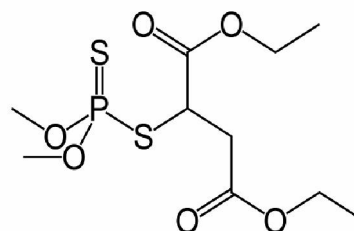
## 2. Electro-catalytic degradation procedures:

### 2.1. Electro-catalytic degradation of pesticides using graphite electrodes

The experiments were conducted by batch process using undivided cell of 250 mL capacity under constant temperature conditions. Electrodes were served by porous graphite. The anode and cathode were positioned vertically and parallel to each other with an inner gap of 0.5 cm. The superficial surface of the working electrode (3.5 cm x 1.5 cm) was  $5.25\text{ cm}^2$ . Different quantities of smashed catalyst were added into the system to form an oxidizing electrochemical reactor. The solution was constantly stirred at 200 rpm with a magnetic stirrer in order to maintain uniform concentration of the electrolyte solution. The electric power was supplied with regulated DC power supply GW (model: GPR-181 OHD, Taiwan).

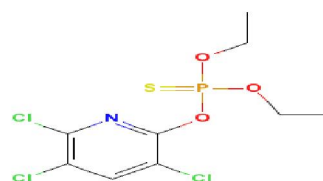
## 3. Chemicals

Chemicals used for degradation are different types of pesticides; malathion, chlorpyrifos and imidacloprid.



Common name: Malathion

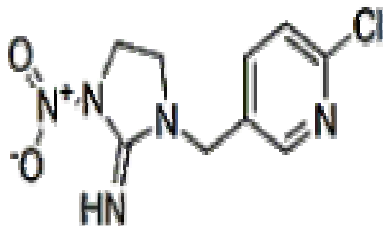
IUPAC name: Diethyl (dimethoxy thio phosphryl thio)succinate



Common name: Chlorpyrifos

IUPAC name: O,O-diethyl o-(3,5,6-trichloro-2-pyridyl)-phosphorothioate





Common name: Imidacloprid

IUPAC name: 1-(6-chloro-3-pyridylmethyl) -N-nitroimidazolidine-2-ylideneamine

#### 4. Analytical measurements

Analytical parameters were measured to evaluate the electro-catalytic oxidation efficiency of above-mentioned organic (pesticides) compounds, these parameters were:

Chemical Oxygen Demand COD ( $\text{mg O}_2/\text{L}$ ), which is a measure of the oxygen equivalent to organic matter content of a sample that is susceptible to the oxidation by strong chemical oxidant. COD can be related empirically to organic matter. COD during the electrolysis was determined by an open reflux (COD reactor, ECO 6, VELP SCIENTIFICA, Italy), dichromate titrimetric method as described in standard methods [6]. This method for the determination of COD may be used where sample chloride concentration is known to be less than  $2000 \text{ mg/L}$ . This means that, in the present investigations the interferences of  $\text{Cl}^-$  ions present in the solution and the electro-generated species may occur. To eliminate the effect of these interferences, two different methods were taken into considerations [7]. The first was carried out by adding sodium bisulphate ( $\text{Na}_2\text{S}_2\text{O}_5$ ) to the organic compound (pesticides) solutions and heating before measurements of COD. The added of sodium bisulphate destroys the hypochlorite with evolution of chlorine gas. The second includes the measurements of COD for blank solutions, which are free from the under test organic compound. These blank solutions were treated under the same operating conditions used in the electro-catalytic oxidation of organic (pesticides) compound solutions. From the measurements of COD values of blank and organic (pesticides) compound solutions after treatment, the value of COD is corresponding to the organic compound present in solution that could be evaluated. The COD values obtained from the two methods were matched with each other. The equation used to calculate the COD removal efficiency in the experiments is:

$$\text{COD Removal \%} = [\text{COD}_0 - \text{COD}_{\text{final}} / \text{COD}_0] \times 100$$

Where,  $\text{COD}_0$  (initial) and  $\text{COD}_{\text{final}}$  of the pesticide solutions are calculated in  $\text{mg/L}$

The average current efficiency (ACE) is calculated by the following equation [8];

$$\text{ACE\%} = (\text{COD}_0 - \text{COD}_t) \text{FV} / 8 \text{ It}$$

Where  $\text{COD}_0$  and  $\text{COD}_t$  are the chemical oxygen demand at initial time and given time  $t$  ( $\text{g O}_2/\text{L}$ ), respectively,  $I$  the current (A),  $F$  the Faraday constant ( $96487 \text{ C/mol}$ ),  $t$  the treatment time (s),  $V$  is the volume of solution (L) and 8 is the oxygen equivalent mass ( $\text{g/eq}$ ).

The energy consumption (EC) is calculated by the following:

$$\text{EC} = \text{UIt} / 3.6 (\text{COD}_0 - \text{COD}_t) \text{ V}$$

Where  $U$  is the voltage applied (V) and other parameters are as defined as before [8].

The optimum operating conditions for the electro-catalytic degradation processes:

Several parameters were studied for investigation the optimum conditions for the degradation synthetic agricultural wastewater (which prepared from pesticides). The studied operating conditions were: current density, initial pesticide concentration, pH and catalyst dose.

### 3- Results and Discussion

#### 3.1. Synergetic effect

In the presence of catalyst (modified kaolin), organic pollutants can be degraded by electrolysis and removed by adsorption. To evaluate the feasibility of adding catalyst into the electro-catalysis process, the efficiencies of COD removal by only modified kaolin, electro-catalysis and their combined process were compared in the same reactor, respectively for the three pesticides. Effect of kaolin's adsorption was performed at the same conditions except the absence of current. The tendency of COD value variation during the whole electrolysis, adsorption process and combined processes in the first 75 min. was shown in Fig. (3) for imidacloprid, malathion and chlorpyrifos pesticides. It can be seen that COD was removed by catalyst adsorption more rapidly than that of by electro-catalysis. Such a combined process obtained a 90%, 95% and 84% COD removal for the three pesticides, respectively compared with 57%, 58.5 and 55 removal in catalyst adsorption process and 31%, 33% and 25% COD removal in electrochemical process, respectively. However, the two processes were environmentally equivalent due to the accumulation of unconverted contaminants on the solid phase by adsorption. Moreover, the whole combined process is a mass transfer process and its COD removal rate may depend on the stirring speed, particle size and also the solution conditions.

#### 3.2. Effect of catalyst concentration

This investigation was carried out in the presence of 1% initial concentration of each pesticide under the following operating conditions:  $100 \text{ mA/cm}^2$ , pH of 3, and electrolysis time of 75 min. Figure (4) show the variation of COD removal % as a function of

modified kaolin catalyst dose for the pesticides. The plots of figure (4) indicated that the COD removal % of pesticides was greatly increased with the increase of kaolin catalyst from 20 to 40 g/L and then slightly increased with increase of kaolin catalyst from 40 to 80 g/L. For this reason the optimum amount of kaolin catalyst ranged from 40 to 60 g/L. A series of experiments was carried out in the presence of presence of 40 g/L kaolin catalyst to investigate the effect of different operating conditions on the rate of the electrochemical degradation of the investigated pesticides. These operating conditions were: current density and pH of solution.

### 3.3. Effect of applied current density

Different current densities of values 50, 100, and 250 mA/ cm<sup>2</sup> were applied on graphite electrode to investigate the electro-catalytic degradation of the investigated pesticides in the presence of 40 g/L kaolin catalyst and pH of 3. Figure (5) show that the variation of COD removal % of pesticides as a function of electrolysis time at different current densities for the investigated pesticides.

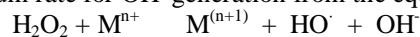
The plots of figure (5) indicated that:

- i) At a given current density, the COD removal % increased with the increase of electrolysis time reaching a limiting value (especially at 100 and 250 mA/ cm<sup>2</sup>).
- ii) At a given time of electrolysis, the COD removal % increased with the increase of applied current density up to 100 mA/ cm<sup>2</sup> and further increase in the current density did not bring any effect. For this reason, the optimum value of the applied current density was taken as 100 mA/ cm<sup>2</sup>. The values of the COD removal % at the optimum current density were: 90%, 95% and 84% for the pesticides imidacloprid, malathion and chlorpyrifos respectively. These COD removal % indicated a good electro-catalytic degradation on graphite electrode occurred for the investigated pesticides. As shown from figures (9-11) at a current density of 100 mA/ cm<sup>2</sup>, the time required for the degradation of 50% of the initial concentration of the pesticide ( $t_{1/2}$ ) is greatly depended on nature of the investigated pesticide. The deduced values of  $t_{1/2}$  were: 11.6, 12.5 and 20.0 minutes for pesticides imidacloprid, malathion and chlorpyrifos, respectively.

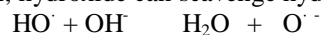
### 3.4. Effect of pH of solution

The obtained results shown in Figure (6) for the pesticides imidacloprid, malathion and chlorpyrifos, respectively indicate that the maximum COD removal was achieved at initial pH of 3, while the removal efficiency decreases with the increase of pH. The better

effectiveness at pH of 3 agrees with the fact that the maximum rate for OH<sup>•</sup> generation from the equation:



Inferred that the optimal operating conditions should be in acid solution, while the diffused oxygen may get electrons easily in this pH region. In alkaline solution, hydroxide can scavenge hydroxyl radicals [9]:



Which influence the oxidizing property of the free radicals (HO<sup>•</sup>) to degrade the organics. These results are similar to the previously obtained [10, 11] which reported that the catalyst displays higher catalytic activity in the acid or moderate acid solutions.

### 3.5. Comparison with homogeneous Co and Cu combined system

To evaluate the effect of Cu<sub>2</sub>O-CoO-PO<sub>4</sub><sup>3-</sup> modified kaolin in electrochemical system concerning the ability to degrade organic pollutants (pesticides malathion, chlorpyrifos and imidacloprid), the homogeneous electro-Co-Cu combined system was applied. 40 g/L CoSO<sub>4</sub> or CuSO<sub>4</sub> (Merck) was added into the solution instead of the modified kaolin. The operating conditions were: 1% initial pesticide concentration, pH of 3 and current density of 100 mA/cm<sup>2</sup>. Figure (7) show the variation of COD removals % as a function of electrolysis time in different electrochemical systems (homogeneous electro-Co-Cu system and the modified kaolin system) for the pesticides (malathion, imidacloprid and chlorpyrifos), respectively. The plots of these figures indicated that:

- i) The maximum COD removals obtained in the modified kaolin system were higher than those obtained in homogeneous electro-Co-Cu system.
- ii) The COD removal rate was faster in electro-Co-Cu modified kaolin combined heterogeneous system than that of electro-Co-Cu catalyzed homogeneous electrochemical system. This as indicated from the value of  $t_{1/2}$  in each of the both systems, where  $t_{1/2}$  values in modified kaolin system were: 11.6, 12.5 and 20.0 minutes for the pesticides imidacloprid, malathion and chlorpyrifos, respectively. While, the values of  $t_{1/2}$  in electro-Co-Cu catalyzed homogeneous system were: 35.0, 34.4 and 31.2 minutes for the pesticides imidacloprid, malathion and chlorpyrifos, respectively.

The multi-transition metals modified kaolin gains more advantages than Co-Cu electrochemical system when treating organic pollutants in aqueous phase. This probable due to its ability to condense pollutants and electro-generated H<sub>2</sub>O<sub>2</sub> onto its big surface and make the degradation reactions more easily to occur. Moreover, because modified kaolin existed electrochemical system is heterogeneous; the adsorbed

multi-metal compounds were stable and friendly environmental pollution [11].

The results of the influence of modified kaolin catalyst on the COD removals% indicated that the optimum amount of the catalyst ranged from 40 to 60 mg/L. The reasons may be lie in that, when the catalyst reaches a certain amount, it will reach equilibrium with electro-generated  $H_2O_2$ , so the generation of  $HO^\bullet$  radicals was mainly determined by the concentration of  $H_2O_2$ . Moreover, because the whole degradation process is mass transfer controlled, its COD removal rate may depend on stirring speed, particle size and also solution conditions. When the catalyst reaches a certain amount, the COD removal may be further influenced by other factors.

### 3.6. Effect of initial pesticide dosage

The results so far have indicated that the maximum electrochemical degradation of the investigated pesticides was obtained at 100 mA/cm<sup>2</sup>, 40g/L kaolin catalyst and pH of 3. Figure (8) shows the effect of different initial pesticides of concentrations 0.5%, 1% and 5% on the variation of COD removal % as a function of electrolysis time under the optimum

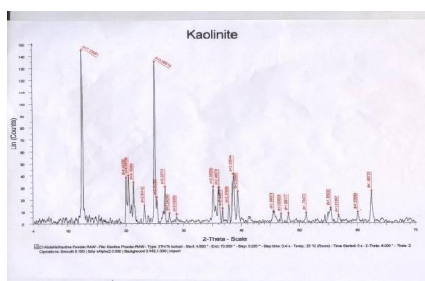
operating conditions mentioned above. Inspection of plots of figure (8), revealed that:

- COD removal % in the presence of 0.5% and 1% of initial concentrations is near to each other.

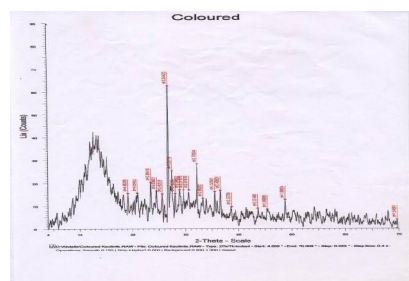
At a given initial loaded concentrations, the COD removal % increased with increase of the electrolysis time with a rate depending on both of nature of each pesticide and its initial concentration. Increasing the pesticides concentration resulted in a decrease in the electrochemical degradation rate of the investigated pesticides.

### 3.7. Calculation of electrical yield (Current Efficiency)

The current efficiency is defined as the ratio between the electrical charge that actually used to oxidize the organic compounds and the total consumed electrical charge [12]. Table (1) represents the current efficiency values and the energy consumption values of the under test electrode used for the electrolysis degradation of the pesticides at their optimum operating conditions.

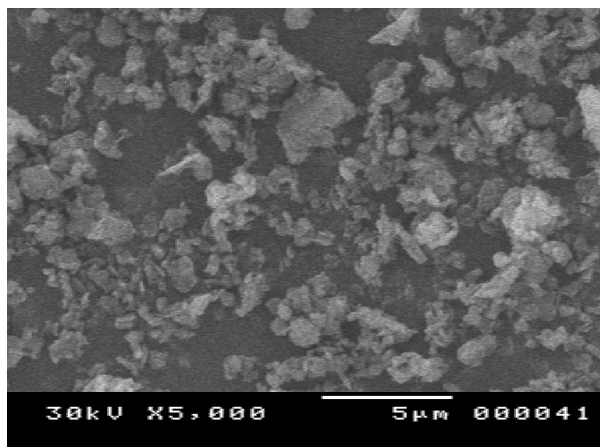


(a) Kaolin

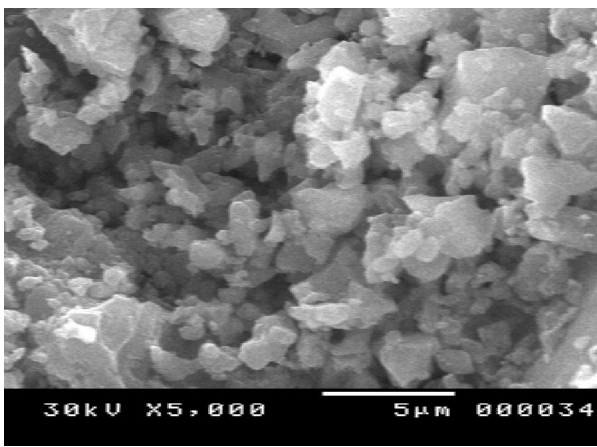


(b) modified kaolin

Fig. (1): XRD patterns of neat kaolin (a) and modified kaolin (b)



(a)



(b)

Fig. (2): Morphologies of neat (a) and modified kaolin (b) by SEM (Magnification 1500x)

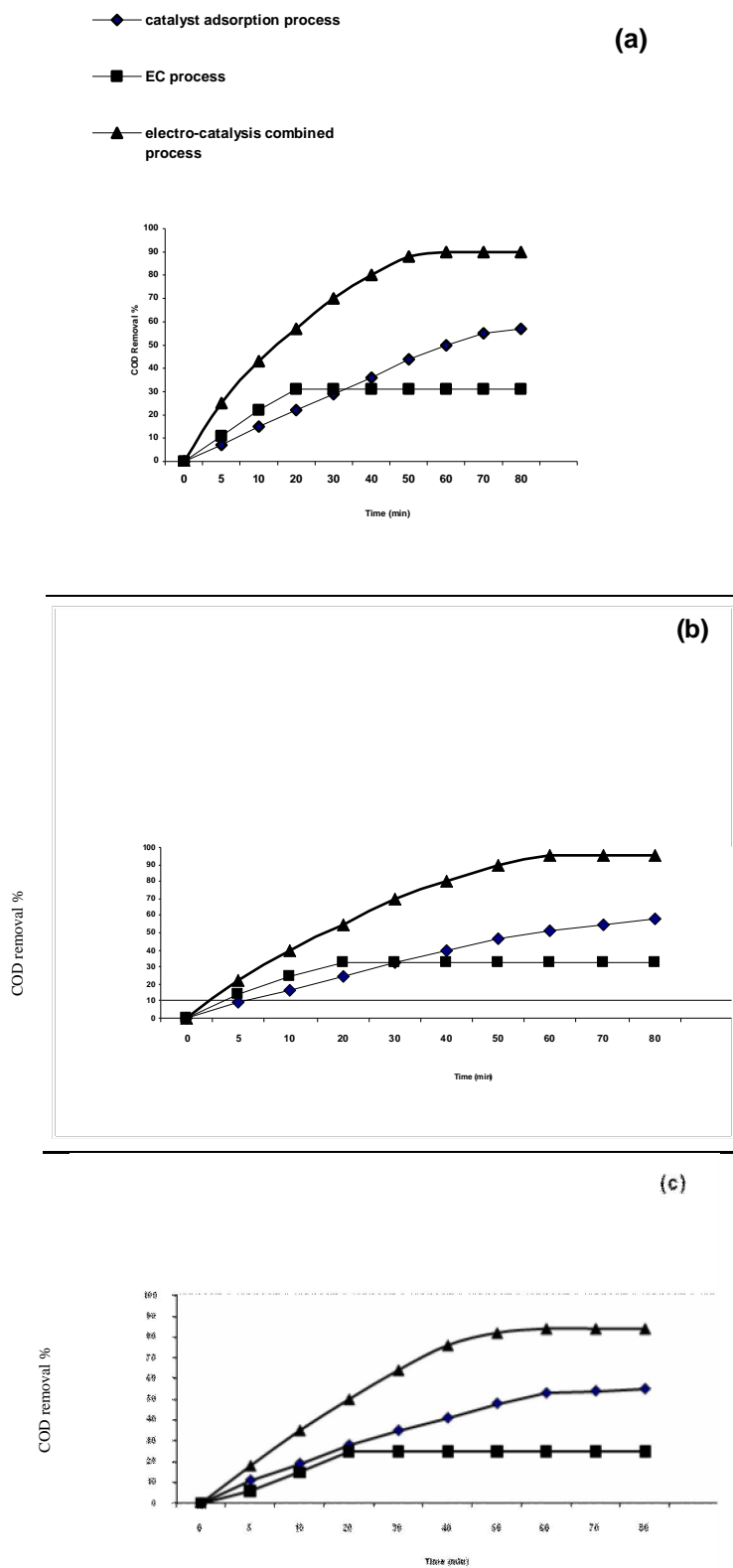
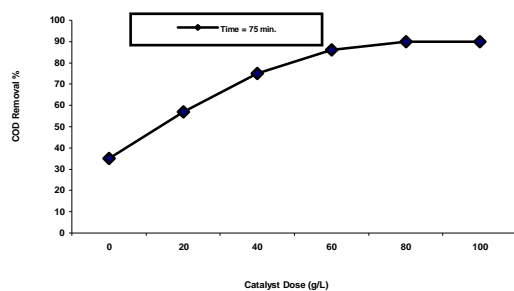
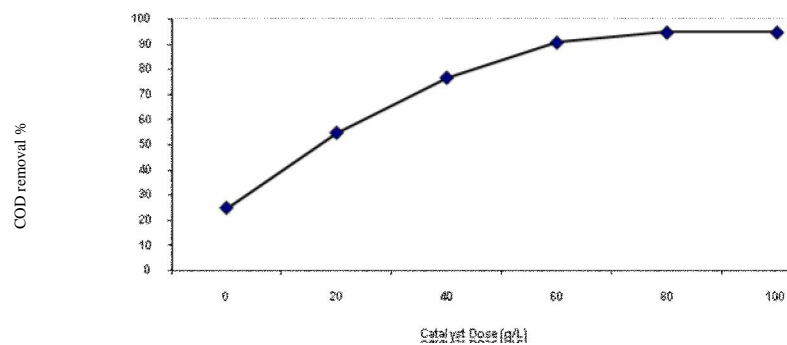


Fig. (3): Synergetic effects on COD removal for 1% concentration of (a): imidacloprid, (b): malathion and (c): chlorpyrifos pesticides (100 mA/cm<sup>2</sup>, pH 3, 40 g/L of kaolin and graphite electrodes).

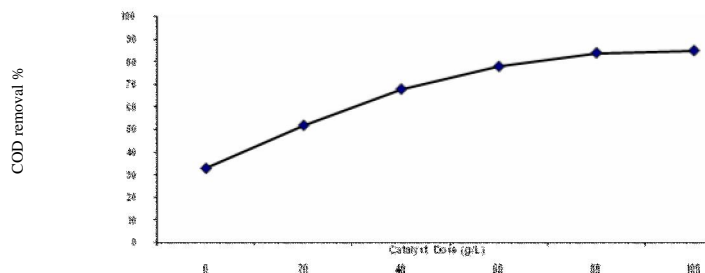
(a)



(b)

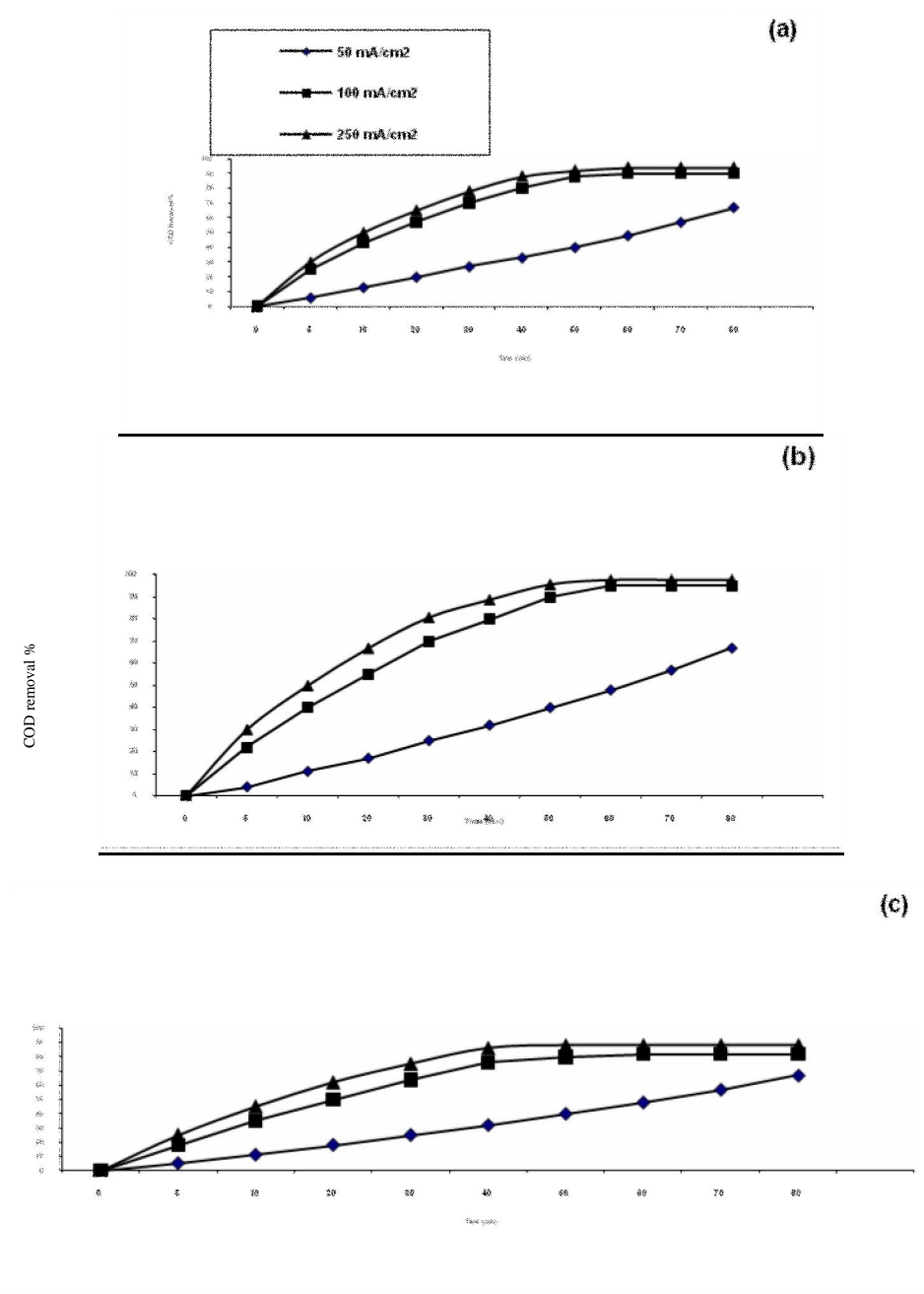


(c)

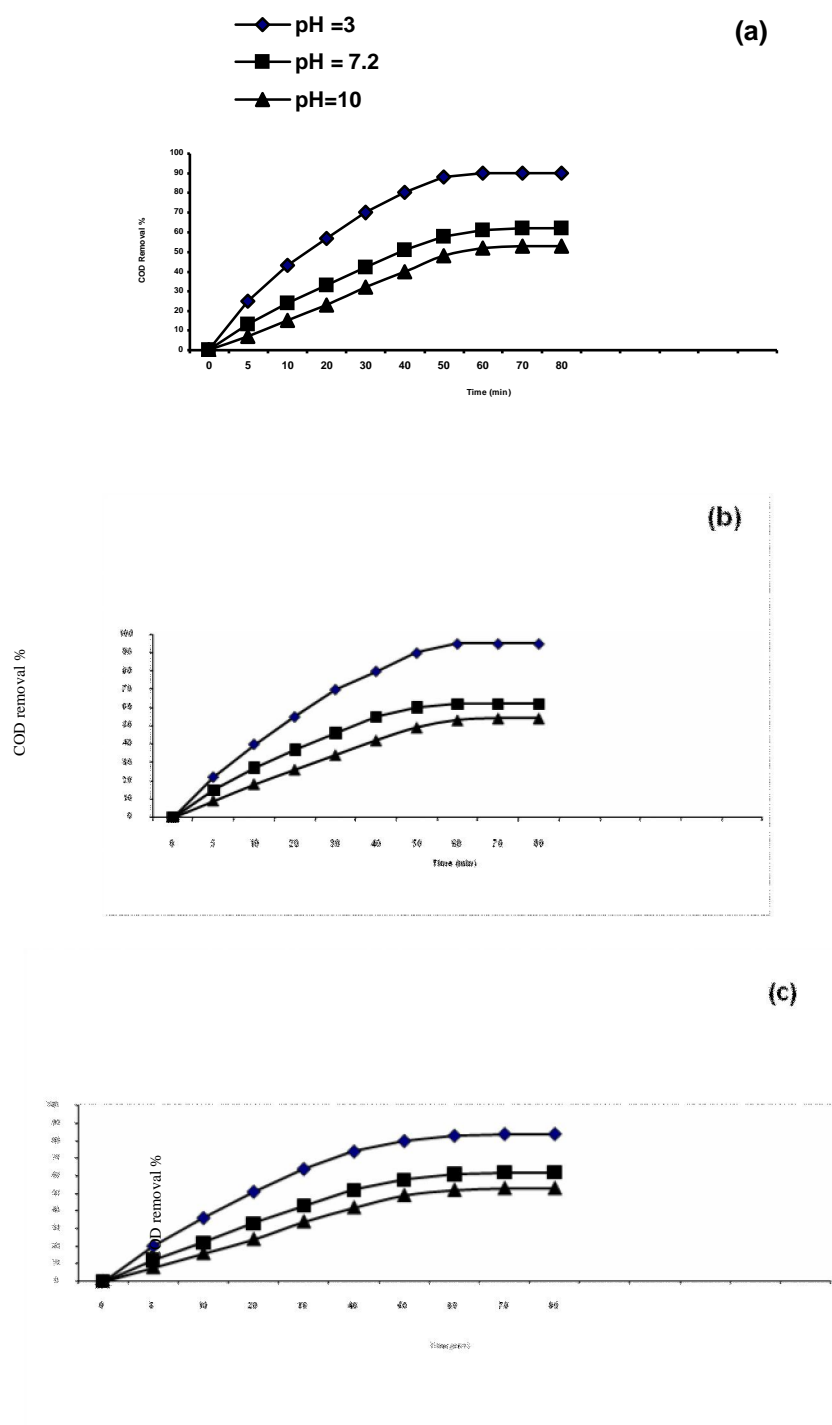


**Fig.(4): Removal of COD with electrolysis time for 1% concentration of (a): imidacloprid ,(b): malathion and (c): chlorpyrifos pesticides with different doses of kaolin catalyst, 100 mA/cm<sup>2</sup>, pH 3 and graphite electrodes.**

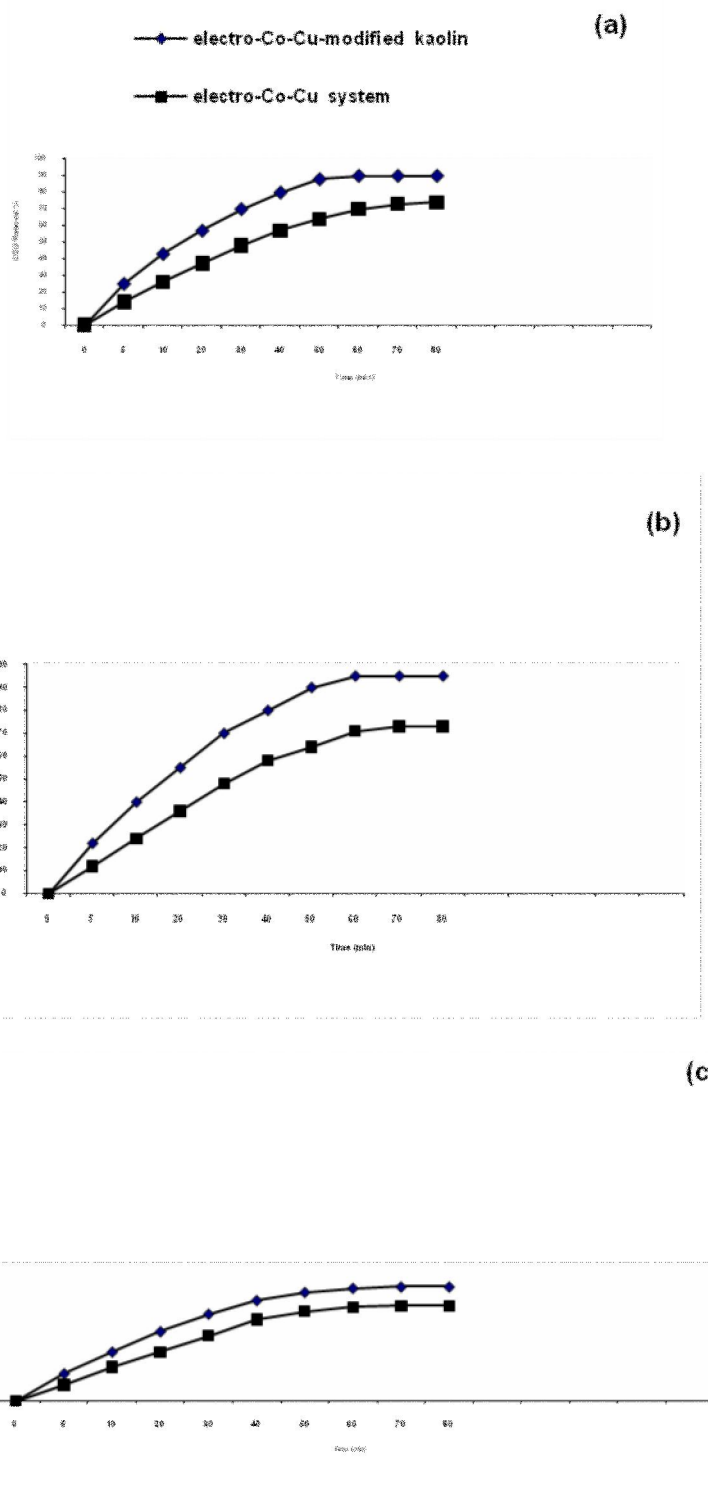




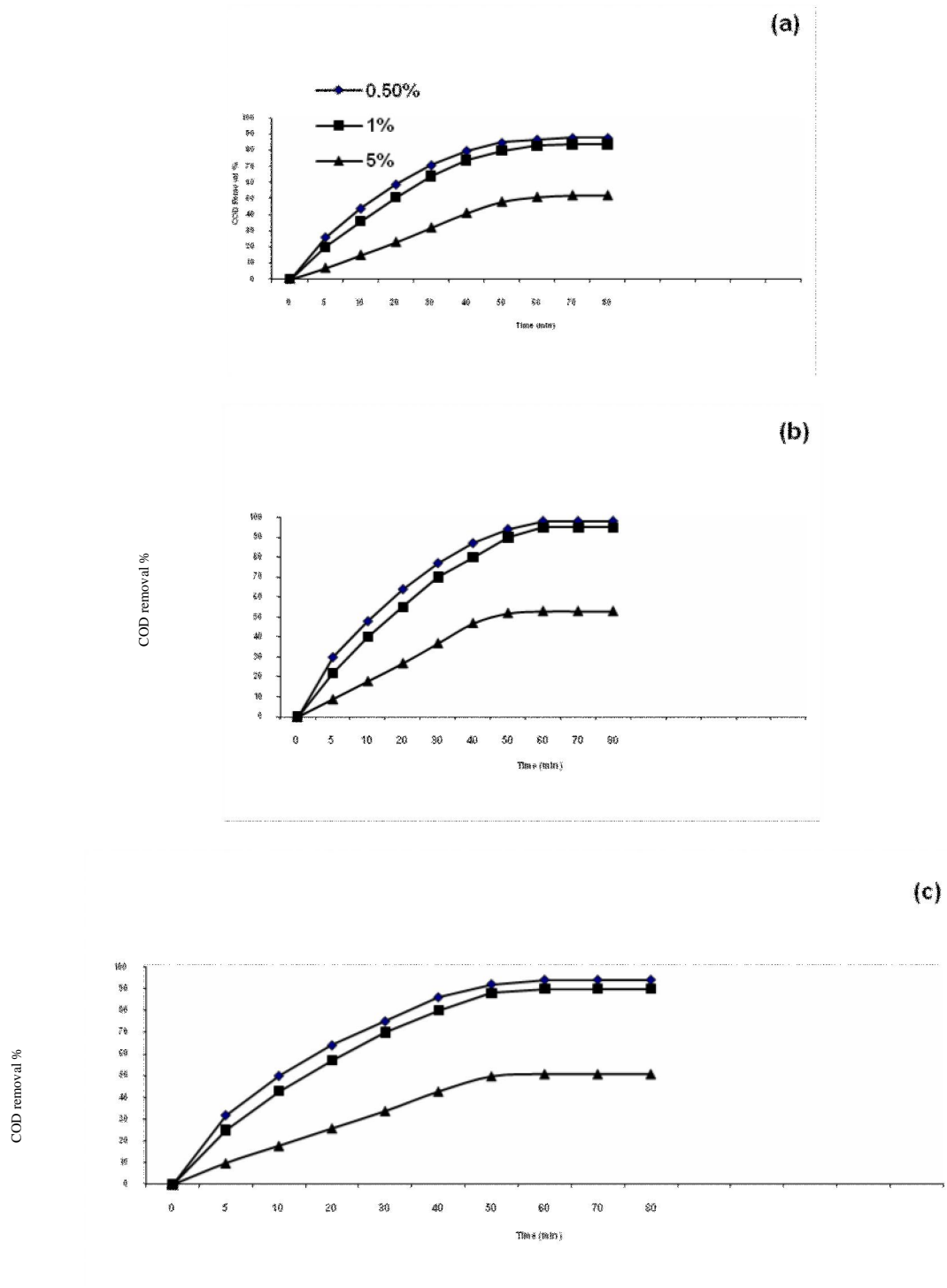
**Fig. (5): Removal of COD with electrolysis time for 1% concentration of (a): imidacloprid, (b): malathion and (c): chlorpyrifos pesticides with 40 g/L kaolin catalyst, pH 3 and graphite electrodes.**



**Fig. (6): Removal of COD with electrolysis time for 1% concentration of (a): imidacloprid, (b): malathion and (c): chlorpyrifos pesticide with 40 g/L kaolin catalyst, pH (3, 7.2 and 10) and graphite electrodes.**



**Fig. (7): Comparison of electro-Co-Cu-modified kaolin heterogeneous system and electro-Co-Cu homogenous system on COD removal for 1% concentration of (a): imidacloprid, (b): malathion and (c): chlorpyrifos pesticides at 100 mA/cm<sup>2</sup>, pH 3 and graphite electrodes.**



**Fig. (8): Removal of COD with electrolysis time for 0.5%, 1% and 5% concentration of (a): chlorpyrifos, (b): malathion and (c): imidacloprid pesticides, 40 g/L kaolin catalyst, pH 3 and graphite electrodes.**

**Table (1):** The current efficiency values and the energy consumption values

Graphite electrodes	Malthion ACE%	Chlorpyrifos ACE%	Imidacloprid ACE%
	88.8	75.4	76.5
EC <sub>(kWh/kg COD)</sub> without addition of catalyst	23.54	26.41	25.12
EC <sub>(kWh/kg COD)</sub> with catalyst	4.75	6.80	5.24

**4. Conclusion:**

The combined electro-catalysis of pesticides present in agricultural wastewater assisted with Cu<sub>2</sub>O-CoO-PO<sub>4</sub><sup>3-</sup> modified kaolin catalyst was performed in single undivided cell. The morphology and phase structure of kaolin before and after modification were studied. Optimal operating conditions such as initial pH, current density were also studied. It was found that when the initial pH was 3, current density was 100 mA/cm<sup>2</sup> and the catalyst dose was 40 g/L, the COD removal rate can reach 95%, 90% and 84% for malathion, imidacloprid and chlorpyrifos, respectively. No significant increase in the COD removal was observed as the current density exceeded 100 mA/cm<sup>2</sup>. The removal of pesticides from agricultural wastewater might be attributed to strong oxidant that produced from the synergetic effect of between modified kaolin and electrochemical system.

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## A study on Required Characteristics of Effective Teachers in Entrepreneurship Education in Iran

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**Abstract:** Entrepreneurship is a way an individual relates to his/her environment be the economic environment or the social environment. Hence, entrepreneurship is important for improve backwardness of the people, economic development of the region, eradication of regional imbalances and better economic gain. Independence, propensity to take risk, personal modernity is some of the characteristics of an entrepreneur. Some scholars argue that education and training need to be placed at the forefront of entrepreneurship. Entrepreneurship education is realized to be a mean of enhancing human capacity. Consequently, there is a great demand for education in all aspects of development. Agricultural education teachers have the knowledge and skills for preparing students to become entrepreneurs who will pass on knowledge to future generations through teaching and practicing the principles acquired at school. In addition, agriculture teachers have the potential to create awareness of entrepreneurship practices among students. The main purpose of this research is identification of required characteristics of effective teachers in entrepreneurship education in Iran.

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**Keywords:** Characteristics, Effective, Agricultural teachers, Entrepreneurship

### 1. Introduction

The agricultural education community envisions “a world where all people value and understand the vital role of agriculture, food, fiber, and natural resource systems”. In order to reach this vision, the strategic plan for agricultural education calls for an abundant supply of highly motivated, well-educated teachers. However, for at least the last 37 years, agricultural education has suffered from a shortage of qualified candidates to accept teaching positions (Rocca and Washburn, 2005).

Although the shortage of qualified teacher candidates has been a continual problem (Camp et al., 2002), the agricultural education literature provides little explanation of the factors that contribute to the teacher shortage. Related research in agricultural education has primarily focused on follow-up studies of recent agricultural education graduates. A few researchers have proposed possible solutions for the shortage; however these studies have not resulted in further investigation. Results of graduate follow-up studies have shown that those who entered teaching were as academically able or more so than their peers who chose not to teach. Graduates who entered the teaching profession were found to have higher cumulative grade point averages and higher grades in student teaching and professional education coursework. Muller and Miller (1993) found agricultural education graduates entering the teaching profession to be no less academically able than their

colleagues who chose to seek employment in other professions (Ibid).

Cole (1984) concluded that teacher educators and teacher preparation programs can have the greatest impact on improving agriculture teacher placement and retention. According to Cole, this can be achieved by ensuring quality student teaching experiences, quality professional and technical preparation, and by reducing specific concerns pertaining to negative outcomes associated with teaching agriculture. Some of the specific concerns mentioned by graduates were spousal support, low salary, long hours, and time for hobbies and recreation.

Another career related concern that has received attention in the agricultural education literature is gender discrimination. Studies have found that the career decisions of female preservice agriculture teachers may be influenced by perceptions of barriers created by gender discrimination. Foster, Pikkert, and Husman (1991) found gender bias to be a definite deterrent to women considering a career in agricultural education. In a nationwide survey of 579 female agriculture teachers, Foster (2001) found 61.7% reported experiencing barriers or challenges due to their gender. When asked the greatest barrier faced by female agriculture teachers, the most common response was “acceptance by peers and other males in industry”. In 1979, Parmley, Bowen, and Warmbrod examined data from previous national supply and demand studies and concluded the teacher

shortage in agricultural education was not a result of a shortfall in the number of graduates from teacher preparation programs, but rather too few of those graduates choosing to enter the teaching profession. Brown (1995) supported this conclusion finding that approximately half of agricultural education graduates were electing not to pursue teaching positions. Brown (1995) found that there were ample numbers of graduates; however the problem lied in insufficient recruitment of those qualified graduates into the profession (Ibid).

In Iran, 23 million people are earning directly from agriculture and nearly 3.5 million of active population is working in this sector. Role of extension and education of agriculture is vital in the agricultural development and can't be gainsaid. Despite the efforts with regards to agricultural development and supporting farmers to improve their competencies in different aspects of their jobs by Iran Agricultural Extension Organization (AES), there are indications that the efficiency and the quality of the support provided by AES have not been enough to serve the farmers' needs. Also AES in Iran is suffering from malfunctions in the area of human resource management and development. Moreover, the challenge of working for extension is included job positions are multidimensional, often including new projects before the old are completed. Frustration and stress are continuous due to the slowness of finishing many projects. Time frames are much longer due to a variety of factors, including a lack of funding, a long approval process, differences between agent and administrative values, and philosophical differences (Asadi et al., 2008).

Some of the definitions of entrepreneurship include:

Confusion with business.

Negative approach: "etatism" is deeply engrained in the political culture.

However, entrepreneurship is a way an individual relates to his/her environment be the economic environment or the social environment.

It is about not accepting things as they are and adapting to their requirements but looking for ways to change it according to one's vision (Ergüder, 2002).

Some of the required reason for entrepreneurship is:

- To improve backwardness of the people.
- Economic development of the region.
- To analysis resource utilization.
- Proper utilization of human potentiality.
- Special attention to take up new activities.
- To create self-employment and generation of employment opportunity.
- Eradication of regional imbalances.
- Better economic gain (Baruah & Com, 2005).

Who is an Entrepreneur?

- He is a person who develops and owns his own enterprise
- He is a moderate risk taker and works under uncertainty for achieving the goal.
- He is innovative
- He peruses the deviant pursuits
- Reflects strong urge to be independent.
- Persistently tries to do something better.
- Dissatisfied with routine activities.
- Prepared to withstand the hard life.
- Determined but patient
- Exhibits sense of leadership
- Also exhibits sense of competitiveness
- Takes personal responsibility
- Oriented towards the future.
- Tends to persist in the face to adversity
- Convert a situation into opportunity (Baruah and Com, 2005).

The characteristics of an Entrepreneur:

- Need for achievement
- High need for power
- Independence
- Propensity to take risk
- Personal modernity
- Support
- Business enterprise
- Leadership (Baruah & Com, 2005).

### Education for Entrepreneurship

The fact that most universities do not have short, medium and long term programme for entrepreneurship indicates how much out of touch we are with the realities of our society. This inadequacy must be overcome urgently and existing undergraduate programmes for agriculture and other disciplines must incorporate content for business development, market research and financial management as optional stream. Every student must have a chance to take one of the three streams, entrepreneurial, extension and research and development. The extension may include work with NGOs, international agencies and cooperatives (Gupta, 2007).

### Key principles

1. Entrepreneurship represents an important engine of economic growth, income and welfare generation and therefore progress for all, social inclusion and stability in a Euro-Mediterranean region aiming to become a free trade area.

2. Entrepreneurship should be considered as a mindset, which can grow throughout society at large, and therefore should not be seen as limited to a business context.

3. Entrepreneurship is about blending risk-taking, creativity or innovation with sound management, within a new or an existing organization and can occur in any sector or type of business.

4. Building an entrepreneurial society involves everybody. An important role is played by the education system and the media in promoting positive attitudes towards entrepreneurship.

5. Since building an entrepreneurial society is both a current need of Euro-Mediterranean societies and an investment in the future, education for entrepreneurship initiatives should address both young people and adults, reaching them through the education system at all levels in a life long learning perspective (primary and secondary school, higher education, vocational training and adult education).

6. Building an entrepreneurial society requires a major pedagogical reform with new ways of thinking and active teaching methods. This will bring the education system closer to the current and future needs (Baruah & Com, 2005).

#### **Required characteristics of agricultural educators**

It is unlikely that any administrator deliberately hires ineffective teachers, or that teacher educators seek to prepare ineffective teachers. Yet, anecdotal evidence suggests that there are ineffective teachers in many schools, in a variety of subject matter areas, including agricultural education. So why does this phenomenon occur, particularly in agricultural education? Perhaps it is because there is little agreement between teacher educators about the specific coursework and experiences required to prepare teachers to be effective. If the characteristics requisite for being an effective agriculture teacher were known, teacher educators could make appropriate decisions in developing preservice students into effective teachers. Subsequently, administrators could make sound decisions in hiring these graduates with the knowledge that they will be effective agriculture teachers. So what are the characteristics of an effective agriculture teacher? (Roberts & Dyer, 2004).

Rosenshine and Furst (1971) identified teacher behavior variables that contributed to teaching effectiveness including:

Variability, enthusiasm, task-oriented, providing students opportunities to learn, using student ideas, amount of criticism (negatively correlated), using structuring comments, types of questions, probing student responses, and level of difficulty of instruction. Young (1990) identified a broader list of characteristics including the ability to plan and execute lessons, monitor student learning and behavior, conduct interesting and focused lessons

based on a variety of methods, and maintain rapport with students and peers. Suydam (1983) indicated that effective teachers let pupils know they are concerned about their achievement; offer encouragement; involve students through questions and discussion; minimize waste time, allowing few distractions and interruptions; establish and follow simple, consistent rules; monitor pupils' behavior carefully; move around the classroom; and give clear directions. Richardson and Arundell (1989) noted that an effective teacher gives a variety of examples, properly plans lessons, is knowledgeable of subject matter, and knowledgeable of student learning (Roberts & Dyer, 2004).

Several studies examined agricultural education teachers specifically. Miller, Kahler, and Rheault (1989) identified five common performance areas for effective agriculture teachers: productive teaching behaviors (which includes designing lifelike situations and activities); organized, structured class management; positive interpersonal relationships; professional responsibilities (which includes completing duties in a timely manner); and personal characteristics (which includes displaying personality traits such as humor and patience). Larsen (1992) and Miller et al. (1989) identified classroom management and classroom organization as influencing the effectiveness of agriculture teachers. Likewise, student motivation, the ability to identify student needs, and recognition of students for their achievements were also identified as characteristics of effective teachers.

According to Luft and Thompson (1995), students identified an effective agriculture teacher as having the following characteristics: showing enthusiasm for teaching, serving as good role models for students, being committed to helping students learn, showing their commitment to teaching by belonging to professional teacher organizations, enjoying teaching, being self confident and poised, being prompt and on time, and being neatly dressed and well groomed. Foster and Finley (1995) reported that effective agriculture teachers were individually strong in human relation and personal attitudes, adept at conflict resolution, highly motivated, committed to personal feelings, utilized good public relation skills, accepted by co-workers, demonstrated leadership and cooperation, possessed good human relation skills, and demonstrated good professional etiquette. Whereas much research exists on the components of effective classroom instruction, additional research explores elements of effective instruction unique to agricultural education. However, missing from the literature base are the characteristics of effective agriculture teachers in terms of their responsibilities in conducting a total agricultural education program.

The responsibility of preparing future effective agriculture teachers to conduct a total agricultural program primarily resides with teacher educators at universities with agricultural education programs. Teacher educators develop coursework and design programs to effectively achieve this outcome. In doing so, they must often rely on their own personal experiences, as there is limited research-based information on the characteristics of effective agriculture teachers in the total school program (Miller et al., 1989). By identifying those characteristics, teacher educators can focus on developing those skills in their students. In summary, Categorized Characteristics of an Effective Agriculture Teacher includes (Ibid).

- Effectively plans for instruction
- Effectively evaluates student achievement
- Communicates well with others
- Effectively recognizes achievements
- Effectively motivates students
- Has a love of agriculture (passionate for subject matter)
- Effectively manages student behavior; maintains discipline in class
- Encourages, counsels, and advises students
- Effectively determines students needs
- Uses a variety of teaching techniques
- Incorporates science and other areas of the school curriculum into the agriculture program
- Has excellent knowledge of the subject matter
- Is innovative; uses technology in the classroom; adapts well to change
- Is capable of solving problems and handling many different tasks at the same time
- Is knowledgeable of teaching and learning theory
- Has a sound knowledge of FFA, actively advises the FFA
- Has a sound SAE knowledge, actively supervises, and encourages SAE projects
- Works well with parents
- Establishes and maintains good community relations
- Works well with alumni and advisory groups
- Works well with other teachers and administrators in his/her school
- Maintains an effective public relations program
- Effectively recruits new students
- Puts in extra hours; is dedicated to doing a good job
- Displays a positive/professional image
- Enjoys teaching and exhibits a positive attitude towards the teaching Profession
- Improves professionally by seeking opportunities for continued Learning
- Takes actions to prevent burnout and to re-energize him/her

- Effectively manages, maintains, and improves laboratories
- Effectively manages, operates and evaluates the agriculture program on a continuous basis
- Effectively manages finances, grants, and special projects
- Cares for students
- Is motivated
- Is enthusiastic
- Is self-confident
- Has an understanding and supportive spouse/family
- Is honest, moral, and ethical
- Is open-minded
- Is well organized; has excellent time management skills
- Is resourceful

## 2. Material and Methods

The methodology used in this study involved a combination of descriptive and quantitative research.

Measuring respondent's attitudes towards e learning has been achieved largely through structured questionnaire surveys. The usual questionnaire approach to measure attitude is to include a range of semantic-differential (with good/bad options for example) and Likert items (with agree/disagree options for example) to operationalize the attitude construct.

Content and face validity were established by a panel of experts consisting of faculty members at Islamic Azad University, Science and Research Branch and some specialists in the Ministry of Agriculture. Minor wording and structuring of the instrument were made based on the recommendation of the panel of experts.

## 3. Conclusion & Recommendations

A limited number of studies have been conducted related to the career decisions of preservice agriculture teachers. These studies were primarily graduate follow-ups and have shown that students who pursue careers in teaching are as academically able or more so, than their peers who chose to not teach. Additional research examining the career decisions of agricultural education graduates is greatly needed in order to address the root causes of the shortage of teachers.

Self-efficacy has been found to have an influence on career decision. Additionally, teacher efficacy had a positive relationship with teacher performance and commitment, as well as the achievement of students. Research investigating the effect of preservice teachers' efficacy on their career decisions is necessary as it may provide a basis for interventions to increase preservice teachers' sense of



efficacy. Such interventions may ultimately impact their decision to enter the teaching profession.

Environmental influences shape learning experiences and moderate the process of transforming career interests into choice actions. Perceptions of barriers, such as gender discrimination, impede career aspirations while support systems facilitate the pursuit of those aspirations. Additional research is warranted to identify potential career barriers and supports for preservice agriculture teachers and to determine the influence of such barriers and supports on an individual's career decisions.

The assertion that effective agriculture teachers possess certain personal qualities is supported by Luft and Thompson (1995), Miller et al. (1989), and Phipps and Osborne (1988). According to the results of this research, if we are to produce effective teachers, the personal qualities identified in this study must either exist prior to the time students enter teacher education programs, or be developed. In a study of teacher education programs, McLean and Camp (2000) reported that most of the teacher education programs they surveyed have curricula that address seven of the eight identified categories. Additionally, their study showed that none of the surveyed teacher education programs specifically contained subject matter aimed at developing the personal qualities identified by this study. Consequently, it is recommended that additional coursework or experiences that focus on the development of personal qualities be provided for preservice teachers.

Interestingly, the greatest number of characteristics was identified within the area of instruction. This verifies the continued belief that for teachers to be effective, they must first master those characteristics that guide instruction – that is, teaching methods/techniques. These similarities empirically verify that being an effective agriculture teacher goes beyond classroom teaching. Creating effective agriculture teachers is imperative for the long-term sustainability of agricultural education programs. Ineffective teachers are likely to become dissatisfied with teaching as a career and seek other

employment opportunities (Bennett, Iverson, Rohs, Langone, & Edwards, 2002). Likewise, if ineffective teachers remain in classrooms, anecdotal evidence suggests that programs close and that countless students will not have an opportunity for education in agriculture.

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# A Study on Impacts on Global Warming on Sustainable Agriculture

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**Abstract:** Agriculture is a human activity that is intimately associated with climate. It is well known that the broad patterns of agricultural growth over long time scales can be explained by a combination of climatic, ecological and economics factors. Sustainable agriculture can be broken into three components: economic, environmental, and social. A major concern in the understanding of the impacts of climate change is the extent to which agriculture will be affected. Global climate change has become an important area of investigation in natural sciences and engineering, and irrigation has often been cited as an area in which climate change may be particularly important for decision- making. Although climate change is expected to have a significant impact on water availability and irrigation requirements, the extend and effect on the water resources planning and management process remains largely unknown. Climate change has many effects on the hydrological cycle and thus, on water resources systems. Global warming could result in changes in water availability and demand, as well as in the redistribution of water resources, in the structure and nature of water consumption, and exasperate conflicts among water users. Impact of global warming on crop water requirements plays a role of paramount importance in assessing irrigation needs. The planning and design process needs to be sufficiently flexible to incorporate consideration of and responses to many possible climate impacts. The main factors that will influence the worth of incorporating climate change into the process are the level of planning, the reliability of the forecasting.

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<http://www.americanscience.org>.

**Key words:** Warming, Global warming, Sustainable agriculture, Forecasting

## 1. Introduction

Global climate change has become an important area of investigation in natural sciences and engineering, and irrigation has often been cited as an area in which climate change may be particularly important for decision- making. According to the Intergovernmental Panel on Climate Change, IPCC (1996), climate change would affect precipitation patterns, evapotranspiration rates, soil moisture and infiltration rates, the timing and magnitude of runoff and the frequency and intensity of storms. Subsequently, changes in evapotranspiration rates can substantially, alter rainfall-runoff processes, adding uncertainty to the understanding of important links between the hydrological cycle and ecosystems behavior. The level of atmospheric carbon dioxide (CO<sub>2</sub>) may, also, affect both water availability and demand, through its influence on vegetation.

Although climate change is expected to have a significant impact on water availability and irrigation requirements, the extend and effect on the water resources planning and management process remains largely unknown. Though a major effort has been devoted to analyzing the potential impacts of global climate change on water resource systems, by

contrast relatively little has been done to review the adequacy of existing water planning and evaluation criteria in the light of these potential changes. In this context, the lack of consistent understanding and application of basic evaluation principles in the agricultural sector has, so far, hindered the prospects for devising an integrated assessment to account for the linkages between climate change and irrigation development. The challenge today is to identify short-term uncertainty. The question is not what is the best irrigation development over the next four or five decades, but rather, what is the best development for the next few years? Knowing that a prudent hedging strategy will allow time to learn and change course.

All these problems will become more pronounced in the years to come, as society enters an era of increasingly complex paths towards the global economy. In this context, European and global environments are closely linked by global processes such as climate patterns, hydrological conditions and socio-economic factors transcending regional boundaries. Consequently, achieving sustainable irrigation development in Europe will depend on the above factors and on the basic policies adopted by

our society in the decades to come (Bakhtiari and Haghi 2003).

### What is global warming?

- A rise in temperature over the earth's surface,
- Thought to cause extremes of weather e.g. drought, floods, hurricanes etc,
- Thought to be caused by human activity,
- Possibly caused by pollution. Chiefly the amount of carbon we add or leave in the atmosphere.
- It may increase temperature levels worldwide (Ewings, 2008).

### How does global warming happen?

- Burning fossil fuels – coal, gas oil etc – releases harmful gases into the atmosphere,
- Carbon Dioxide (CO<sub>2</sub>) is one of these gases – it is called a “greenhouse” gas because it stops heat escaping from the atmosphere,
- By continually producing CO<sub>2</sub> we are trapping even more heat in the atmosphere causing global warming,
- CO<sub>2</sub> has increased by 10% in the last 100 years (Ibid).

### What are the consequences of global warming?

- Polar ice caps could melt – evidence suggests this is already happening – increasing sea/ocean levels,
- Causes flooding to low lying land – particular problems for countries like Netherlands and Bangladesh,
- Less water vapour in the atmosphere leading to more drought,
- Causes extremes of weather – hurricanes, flooding and droughts – which is very problematic for areas which do not normally have these types of weather conditions,
- Reduction in Ozone Layer which protects the world from ultra violet rays from the sun (Ibid).

### What is meant by sustainable agriculture

The classic definition of sustainability gleaned from the Brundtland report rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. In relation to environmental considerations the basic issue is

whether agricultural activities can produce food efficiently and at low cost (and therefore benefit consumers) and profitably (benefiting farmers) without degrading natural resources. Advances in productivity, linked to pesticide use, mechanization, livestock intensification etc., have invariably been associated with environmental damage as noted above. In Northern Ireland for example the use of animal wastes and artificial fertilisers have contributed to the eutrophication of many rivers and lakes while fish kills are regularly reported due to release of farm effluent into freshwaters. However, the concept of sustainable agriculture is a complex one that incorporates a number of other, arguably, equally important factors.

Legg points out that while the basic premise of sustainable agriculture, outlined above, is easily understood there are important characteristics of sustainable development applicable to agriculture that should be noted:

“First, it is a dynamic process, which focuses on the ability of the economy to meet demand in cost-efficient ways through developing, combining and substituting resources in the production process — provided that there are appropriate signals to producers and consumers on which they can make their decisions.

• Second, it is a global concept, which recognises that allowing flows of resources between sectors and economies through international trade can maximise production while reducing pressure on fragile resources.

• Third, it is a multidimensional phenomenon, encompassing economic, environmental, and social dimensions. The concept of sustainable development goes beyond the economic growth that is conventionally measured in Gross Domestic Product, and takes into account the state of resources and environmental performance of the economy, as well as current and future social and distributional aspects (Northern Ireland Assembly, 2001).

### Objectives for sustainable agriculture

Sustainable agriculture must:

Produce safe, healthy food and non-food products in response to market demands, now and in the future

Enable viable livelihoods to be made from sustainable land management, taking account of payments for public benefits provided

Operate within biophysical constraints and conform to other environmental imperatives

Provide environmental improvements and other benefits that the public wants - such as re-creation of habitats and access to land

Achieve the highest standards of animal health and welfare compatible with society's right of access to food at a fair price

Support the vitality of rural economies and the diversity of rural culture

Sustain the resource available for growing food and supplying other public benefits over time, except where alternative land uses are essential in order to meet other needs of society (Sustainable Development Commission, 1999).

### **The Components of Sustainable Agriculture**

Sustainable agriculture can be broken into three components: economic, environmental, and social. While discussed separately here, it should be noted that the goals overlap, impacting and influencing each other. For example, economic decisions will also impact the environmental and the social components.

#### **Economic sustainability**

To be truly sustainable, a farm must be economically profitable. The environmental and social benefits of sustainable production methods do not always translate into economic gains. Some farms that operate sustainably may be more profitable than their conventional farming counterparts; however, the reverse can also be true. Many factors aside from crop production methods can affect the bottom line. These can include, among other things, the grower's management strengths/weaknesses, decision making abilities, and marketing skills. That said, sustainable agriculture practices can have a positive economic impact on a farm. For example, diversifying the farm with several crops and markets helps to reduce financial risk.

### **ENVIRONMENTAL SUSTAINABILITY**

Environmental concerns are central to sustainable agriculture. Sustainable agriculture is frequently described as: ecologically sound practices that have little to no adverse effect on natural ecosystems.

However, more than that, sustainable agriculture also seeks to have a positive impact on natural resources and wildlife. This can often mean taking measures to reverse the damage (e.g. soil erosion or draining of wetlands) that have already occurred through harmful agricultural practices. Renewable natural resources are protected, recycled,

and even replaced in sustainable systems. Also inherent to sustainable agriculture environmental concerns is the stewardship of non-renewable resources, such as fossil fuels.

Achieving a healthy, balanced ecosystem takes time. Making the transition to sustainable farming is a process that generally requires moving forward step-by-step. While there are common goals that are critical to sustainable agriculture, there is no single approach that will guarantee sustainable success on every farm. The methods for accomplishing those goals must be tailored to the individual farm.

A key to successful sustainable production is healthy soil. Depending on the condition of the soil, it can take several years to build up organic matter and improve soil quality. Sustainable methods of enhancing soil fertility and improving soil structure can include: using nitrogen fixing legumes, green manure, and animal manure; minimizing or eliminating tillage; and maintaining year round soil cover. Fertilizer decisions are based upon soil test results. While synthetic fertilizers can be used to supplement natural inputs, they are applied on an as-needed basis. Synthetic chemicals known to harm soil organisms and soil structure must be avoided in sustainable agriculture.

Insects, diseases, and weeds are managed, rather than controlled, in sustainable systems. The goal is not necessarily the complete elimination of a pest, but rather to manage pests and diseases to keep crop damage within acceptable economic levels. Sustainable pest management practices emphasize prevention through good production and cultural methods. Some strategies include:

Using crop rotations that will disrupt the pest life cycle, improving soil quality, practicing good sanitation, using optimum planting densities, timing planting and transplanting operations to avoid high pest populations, employing biological control, and growing resistant varieties. Monitoring pests through frequent crop inspections and accurate identification are essential to keeping ahead of potential problems. Many Integrated Pest Management techniques can be incorporated into a sustainable program.

#### **Social sustainability**

Social sustainability relates to the quality of life for those who work and live on the farm, as well as those in the local community. Fair treatment of workers, positive farm family relationships, personal interactions with consumers, and choosing to purchase supplies locally (rather than from a more distant market) are just some of the aspects considered in social sustainability.

Community supported agriculture (CSA), farmers markets, U-pick, cooperatives, and on-farm events are just some of the ways a sustainable farm can have a positive impact on the local community. In essence, the farm supports the community and the community supports the farm (Kluson, 2001).

### Constraints in Achieving Sustainable Agriculture

Climate change could cause irreversible damage to land and water ecosystems and loss of production potential in agriculture. It would affect the agro-ecological suitability of crops, which may lead to increased pest and disease infestations. Climate change will have a disproportionate impact on poor people in rural areas where livelihoods of the majority depend on agriculture. Depletion of soil fertility and degradation of forest resources, water resources, pastures, and fisheries is already aggravating poverty in the country (Manzanilla, 2007).

### Environmental impacts of agriculture

Soil quality the soil itself should be protected from further erosion, salination, loss of organic matter and accumulation of Heavy metals. Loss of organic matter from soils means increased greenhouse gas emissions as carbon is released. The National Soil Inventory has shown that the organic content of soils is decreasing.viii Soil quality is of course vital to the long-term productivity of farming.

Landscape Farming shapes much of our landscape – over 70 per cent of UK land is farmed.

Water quality and quantity Use of water for irrigation has increased dramatically over the past 20 years. Over-abstraction of water is already causing damage to ecosystems, while use of irrigation can cause soil salivation over time. Surface and ground water must be protected from pollution by animal waste, cryptosporidium, pesticides, nitrates and phosphates. In 1999 agriculture was the source of 14 per cent of water pollution incidents in England and Wales. In addition to pollution incidents, agriculture also delivers low level pollutants to watercourses, such as pesticide and fertilizer run off from fields. Agriculture is also the main source of nitrogen in watercourses, which causes eutrophication.

Air quality Farming creates dust and smells, and contributes to acid deposition. Agriculture's contribution to acidification has become proportionally more important as other sectors have reduced emissions.

Climate Agriculture directly emits around 8 per cent of UK greenhouse gases. These emissions are projected to decline in the future, due to reduced and more targeted use of fertilizer, and a decrease in livestock numbers resulting from market and policy constraints. I Agriculture's contribution is predominantly through emissions of methane and nitrous oxide.

Biodiversity Protecting the genetic resource base, in terms of species used for food and also other life on and around farms is essential. We must protect the current diversity of plants and animals used for food – this will ensure that food production systems are robust in the face of disease and changing environmental conditions.

Wildlife and semi-natural habitats there is a need to protect the diversity of animal and plant life associated with farming. Wildlife is important as part of the genetic resource base, and also because of its value to people (Sustainable Development Commission, 1999).

## AGRICULTURE AND ENVIRONMENT

### A. Agriculture and land use

The term "land use" is more comprehensive than the term "soil use". Land, commonly, stands for a section of the earth's surface, with all the physical, chemical and biological features that influence the use of the resource. It refers to soil, spatial variability of landscape, climate, hydrology, vegetation and fauna, and also includes improvements in land management, such as drainage schemes, terraces and other agrobiological and mechanical measures. The term "land use" encompasses not only land use for agricultural and forestry purposes, but also land use for settlements, industrial sites, roads and so on [1].

### B. Land degradation and desertification

Because of the current climate patterns and intensification of human activities Mediterranean countries are already faced with a real threat of land degradation and desertification and there is no doubt that the present enhanced greenhouse effect will only exacerbate this threat in the short term.

The main causes of these processes can be summarized as follows:

- change of agricultural systems towards specialized – mechanized hill farming;

- modification of morpho – structural and infrastructural features of the cultural landscape concerned;

- abandoned, previously cultivated fields and/or farms and their man-made structural and infrastructural elements;

- increase in forest and pasture fires.



In the eighties and early nineties, global warming and the impact of the agricultural systems introduced in the sloping lands of the Mediterranean environment in the previous decades were identified as the main culprits of soil erosion and land degradation. Accelerated runoff and erosion, previously unreported, began to be observed in cultivated sloping areas. The unprecedented pressure to increase crop productivity at lower costs, made possible by the technological revolution in agricultural management, had led to soil erosion in the agricultural ecosystem, due to hydrological impact, resulting in severe deterioration in soil fertility and degradation of the landscape.

After having thoroughly examined the problem, the scientific community concluded that a more detailed evaluation of the situation in the different Mediterranean environments was needed.

Furthermore, it was recognized that research activities were too fragmentary to be able to cope with the demand for sound soil conservation measures. Another recommendation that emerged was the use of pilot areas for a quantitative assessment of accelerated erosion and of the effects of new conservation measures in the water erosion prone areas of the Mediterranean. It was also suggested that projects be allowed more flexibility, so that programs could be modified during implementation, to benefit from experience gained and lessons learned (De Wrachien, 2004).

#### C. Agricultural and water use

In the Mediterranean region nearly 70% of the available water resources are allocated to agriculture. In the arid and semi-arid countries of the region agricultural water use accounts for as much as 80% of the water consumed, decreasing to 50% of the total available resources in the Northern countries.

## Conclusion

Agriculture is a human activity that is intimately associated with climate. It is well known that the broad patterns of agricultural growth over long time scales can be explained by a combination of climatic, ecological and economics factors. Modern agriculture has progressed by weakling the downside risk of these factors through irrigation, the use of pesticides and fertilizers, the substitution of human labour with energy intensive devise, and the manipulation of genetic resources. A major concern in the understanding of the impacts of climate change is the extent to which agriculture will be affected. The issue is particularly important for the Mediterranean countries, where water availability and sustainable irrigation development pose a

growing problem under today's climatic Conditions and entropic pressure. Thus, in the medium and long terms, climate change is an additional challenge that agriculture has to face in meeting national food requirements.

Climate change has many effects on the hydrological cycle and thus, on water resources systems. Global warming could result in changes in water availability and demand, as well as in the redistribution of water resources, in the structure and nature of water consumption, and exasperate conflicts among water users. Scenarios based on GCMs forecasts do not provide sufficiently reliable information for the assessment of the hydrological consequence of climate change at the scale of the Mediterranean region. Nevertheless, it is reasonable to assume that the largest changes in the hydrological cycle are expected for the snow dominated basins of the Alpine Europe, while annual stream flow is likely to decrease over the river basins in the southern part of the region.

Impact of global warming on crop water requirements plays a role of paramount importance in assessing irrigation needs. In the last decade, global vegetation models have been developed that include parameterization of physiological processes such as photosynthesis, respiration, transpiration and soil water intake. These tools have been coupled with GCMs and applied to explore future scenarios at both regional and world-wide levels. In the context of the Mediterranean environment the models outcomes show that irrigation requirements are likely to increase in most irrigated areas in the north of the basin, while in the south the patten becomes complex.

Concerning irrigated agriculture, most of the current 16 million ha of irrigated land, in the Mediterranean, were developed on a step by step basis over the centuries, and were designed for a long life (50 years or more), on the assumption that the climatic conditions would not change. This will not be so in the future, due to global warming and the greenhouse effect. Therefore, engineers and decision-makers need to systematically review planning principles, design criteria, operating rules contingency plans and water management policies.

Uncertainties as to how the climate will change and how irrigation systems will have to adapt to these changes is issues that water authorities are compelled to address. The challenge is to identify short-term strategies to cope with long-term uncertainties. The question is not what the best course for a project is over the next fifty years or more, but rather, what is the best direction for the next few years, knowing that a prudent hedging strategy will allow time to learn and change course.



The planning and design process needs to be sufficiently flexible to incorporate consideration of and responses to many possible climate impacts. The main factors that will influence the worth of incorporating climate change into the process are the level of planning, the reliability of the forecasting.

The development of a comprehensive approach that integrates all these factors into irrigation project selection, requires further research on the processes governing climate changes, the impacts of increased atmospheric carbon dioxide on vegetation and runoff, the effect of climate variables on crop water requirements and the impacts of climate on infrastructure performance.

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## Improving Secondary Collection of Solid Waste: The Experience of Performance Based System in Lahore

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**Abstract:** Like cities of many developing countries, solid waste management in Lahore is a serious challenge and constrained by economic, institutional and operational factors. The Solid Waste Management Department (SWMD) of the City District Government Lahore (CDGL) initiated a performance based system (PBS) of secondary collection of waste with the view to improve the service and make effective use of the available resources. The paper provides an assessment of the new system using data regarding various aspects of waste collection service under the PBS and discussions with concerned officials. The analysis of data shows that there are signs of improvement both in terms of quantity of waste now lifted and brought to dumping site as well as the cost incurred on this service. The paper concludes that there is scope for replicating this system all across the city but certain aspects need to be given due consideration to ensure its smooth operation in the long run.

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**Keywords:** Performance Based System (PBS); Solid Waste Management; Secondary Collection; City District Government; Lahore.

### 1. Introduction

Inadequate arrangements for solid waste collection and disposal are one of the causes of environmental degradation in cities of developing countries. Concerned local agencies find themselves unable to handle increasing quantities of waste. This often results in uncollected waste on roadsides, street corners or other open spaces in cities thus posing health risks for the people (Kaseva and Mbuligwe, 2005, Rathi, 2006; Imam et al, 2008). Cities in Pakistan are also facing this challenge of increasing quantities of solid waste in the wake of rapid urban growth and economic development. For instance, Shoaib et al (2006) and Altaf & Deshazo (1996) highlight the problems of solid waste management facing the cities of Multan and Gujranwala respectively.

The city of Lahore is no exception to the above mentioned situation where the impact of improper management of solid waste has become more and more visible over the years. The Solid Waste Management Department (SWMD) of the City District Government Lahore (CDGL) is responsible for provision of waste collection and disposal service. But it is unable to extend this service to all parts of the city. The entire efforts are restricted to shifting waste from formal and informal collection points from parts of the city to dumping sites or low lying areas at the outskirts and regular road sweeping both manually and mechanically usually in affluent localities. Even

secondary waste collection has been inefficient and marred by problems like less than expected number of trips of waste collection vehicles to lift the waste and fuel pilferage. Realizing this situation the SWMD launched a performance based system (PBS) of secondary waste collection involving payment of remuneration to drivers according to amount of waste delivered at officially managed dumping site. This paper provides an assessment of the PBS. The next section gives a brief situational analysis of waste management in Lahore. Then it explains the PBS introduced by the CDGL. This is followed by an analysis of the effectiveness of the system. The final section draws the conclusions.

### 2. Background

Being the second largest city of Pakistan and the capital of Punjab province, Lahore is a large sprawling city accommodating an estimated population of somewhere around 10 million as per mid-2006 government estimates (<http://en.wikipedia.org/wiki/Lahore>) [accessed March 14, 2011]. Over the years the city has evolved as a cultural, educational, recreational, transportation, and industrial centre of the nation. Rapid and continual increase in population, economic growth and consumption activities have been contributing to ever increasing quantities of solid waste in the city. Table 1 gives a description of waste composition and total

waste generated presently in Lahore. Around 5700 tons of solid waste is generated daily from different sources with organic waste being produced in largest quantity (approximately 3025 tons or 53% of the total waste). It may be pointed out here that approximately 350-450 tons of organic waste is utilized for preparation of compost using windrows method by a private contractor on BOT basis under public-private partnership arrangement with CDGL. The composting plant set up for this purpose is located at the only official dumping site at Mahmood Booti in the north of the city.

There is no proper system of door-to-door collection of waste from producers (e.g. households, commercial establishments etc.) except in some middle and high income localities where private sector operators offer this service on nominal charges. Generally waste is thrown by producers in or around waste containers (where available), open heaps at curb sides, open plots or other informal collection points or into open drains and sewers. The sanitary workers of the SWMD primarily collect waste by manually sweeping the streets and even by cleaning open drains and bring the same in handcarts or wheelbarrows to collection points. Waste from these collection points is then loaded onto vehicles of varying capacities by the concerned staff of SWMD and transported for final disposal (see below for details).

The rate of collection of waste generated in Lahore has been observed to be around 76% but only part of it reaches at the official dumping site for final disposal. In the absence of adequate dumping sites at appropriate locations, the rest of the collected waste is dumped by drivers at any open space in and around the city. The uncollected waste (24%) is left at roadsides, street corners or open plots thus creating environmental nuisance and posing health risks for the people (Ernst Basler/ICEPAK, 2007, and KOICA/World Bank/KEI/SLC, 2007). A considerable amount of recyclable waste is also collected by scavengers from containers, informal collection points as well as from the dumping site. According to an estimate, roughly 15,000 scavengers are involved in recycling activities in Lahore and the total market value of recyclables is estimated to be around Rs. 2-3 million per day (Ernst Basler/ICEPAK, 2007).

The practice of disposing off hospital waste (generated at the estimated rate of 3.5 tons per day) together with municipal waste also poses risks for human health and environment. For instance, there are 40 hospitals in the public sector in the city but only 4 have incinerators for hazardous waste which according to an estimate accounts for 29% of hospital waste. Generally sweepers of the hospitals collect waste from inside the hospital premises and throw it in roadside

containers meant for household and commercial wastes (Ernst Basler/ICEPAK, 2007).

The SWMD of the CDGL has a total of 8,544 staff to ensure proper handling of waste in Lahore. This includes 7,897 sanitary workers responsible to clean the roads and transfer waste from collection points to vehicles for further disposal. Although this strength of sanitary workers has been observed to be appropriate (810 inhabitants per worker based on 2006 estimated city population of 6.4 million) if compared to international bench mark (1000 to 1500 inhabitants per worker). Their number would need to be increased any way if 100% waste is to be removed from the city. Moreover, there is a big shortage of professional staff at the supervisory and management level (Ernst Basler/ICEPAK, 2007). The situation concerning solid waste management expenditure and cost recovery has also not been encouraging. For instance, the SWMD spent around Rs. 1459 million during the budgetary year 2006-07 (which formed 16% of the total budget of the CDGL) on waste management. As much as 82% (of Rs. 1459 million) was used in payment of salaries to staff while the rest of money was exhausted on fuel, some repairs and maintenance. But against the spending, the recovery of cost of service (through solid waste management fee imposed @ 30% on water bill) was hardly 8% of the total recurrent costs (Ernst Basler/ICEPAK, 2007).

### 3. Secondary Collection of Waste in Lahore

The SWMD has a fleet of over 350 vehicles for transportation and secondary collection of waste from containers, skips, and open collection points located across various parts of the city. This includes arm rollers, open body trucks, tractors with trolleys/buckets, and compactors. These vehicles have been allotted for each of 9 administrative sub-divisions (town municipal administrations) of the city. The drivers and helping staff of each vehicle are required to collect waste from formal and informal collection points along a route and bring it to official dumping site for final disposal. For this purpose they are given a fixed amount of fuel depending upon the expected number of trips (generally 4 to 6) from various parts of the city to the dumping site. However, despite receiving fuel for expected number of trips, the drivers actually make as few trips up to the official dumping site as possible (generally not more than 2 trips) or curtail the trips by dumping waste (removed from the affluent or politically influential localities) in low income localities or areas having no political voice. The fuel thus saved is then sold by the drivers in the market at comparatively low price to supplement their income. These weaknesses in the waste management system have also been noted by others (see for instance,

Iftekhar, 2003; Khan, 2004). The system has failed to perform satisfactorily due to lack of proper monitoring arrangements and method (for example accurate maintenance of log book) for controlling the movement of vehicles as well as lack of proper mechanism to measure work efficiency (for example the amount of waste lifted by drivers of each vehicle).

#### 4. The Performance Based System

The increasing level of inefficiency of SWMD in lifting waste from various locations in the city prompted the CDGL to bring some change for improvement. After reviewing the existing situation, the CDGL realized that the SWMD has the potential to improve service delivery at least by ensuring that the available resources in the form of staff, vehicles, and fuel are used to optimal level. It also identified the need to change the secondary waste collection system from input (providing diesel) to output/performance based (measured in terms quantity of waste brought to dumping site) by creating some incentive for the drivers for efficient working. Therefore, it planned the performance based system (PBS) of secondary waste collection whereby drivers of collection vehicles were to be paid in cash on the basis of amount of waste delivered at the dumping site. For this purpose a weighbridge along with computer centre was established at the dumping site (which started functioning in January 2006). It was expected that besides motivating the drivers to remove maximum quantity of waste, the new system will help in making the city clean. Moreover, it will not only resolve the problem of fuel pilferage but also ensure that drivers will be left with no option but to bring it to dumping site unlike the past practice of dumping the waste anywhere else.

The next section provides an assessment of this new system of secondary waste collection. The assessment is based on data obtained from the office of the SWMD Lahore regarding 15 vehicles for which it was possible to make comparison of before and after situation of amount of waste delivered at disposal site (efficiency) and cost incurred in this process (cost-effectiveness). Discussions were also held with concerned officials to clarify various aspects of the new and conventional systems of secondary waste collection. The impact of the PBS on cleanliness around collection points is based on comparative field observation done by the second author as part of her M Sc thesis (see Nazir, 2009) along selected two PBS and two conventional routes in Lahore.

##### 4.1 General

The new system was launched in February 2006 initially on 44 selected routes with those waste

collection vehicles already responsible (even before the PBS) to bring solid waste at official dumping site at Mehmood Booti (where weighbridge was setup). In the beginning, the fleet involved in collection and transport of waste comprised of arm-roll trucks, open trucks (dumper), tractor trolleys and compactors. Later, open trucks, tractor trolleys and compactors were pulled out of the PBS due to problems in managing the operation of these vehicles. For instance, these vehicles were to be used to remove waste from open dumps and heaps of rubbish located along the prescribed routes (unlike arm-roll trucks which were to collect waste from containers). But the staff (usually 1 driver and 2-4 helpers) of these vehicles started collecting waste from here and there as well in addition to the open dumps along the prescribed routes so as to bring more and more waste to the dumping site and hence earn as high incentive payments as possible. Similarly there were conflicts related to fuel consumption per trip. For instance, the drivers claimed higher quantities of fuel use (due to collecting waste from various places other than those along the prescribed route) as compared with the pre-determined average quantities applied by managerial staff while calculating the incentive payments. The later were based on average fuel consumption by a vehicle plying on a prescribed route.

Presently, 100 (out of 362) routes in 6 (out of 9) towns are operational under the PBS. Arm-roll trucks are involved in collection and transport of waste from containers placed along the allocated routes. One vehicle is allocated one route and the driver is accompanied with a helper. Although the number of containers/skips (collection points) varies from one route to another depending upon the nature of waste generating area and route-length, each vehicle on average lifts waste daily from 6-7 Containers/skips placed at different locations along the route. In the beginning waste removal was done seven days a week along PBS routes but now it is done six days a week with Sunday as weekly holiday. A team of inspectors is responsible to monitor the operation of staff along PBS routes with the view to maintain efficiency in waste collection and disposal.

##### 4.2 Waste delivery at disposal site

Table 2 provides a comparison of waste delivery situation of selected vehicles before and after the introduction of PBS. It is clear that there is a significant improvement in waste delivery at the disposal site with an overall average increase of 67% in waste lifted per month by the selected vehicles on their respective routes over the years. It may be pointed out here that variation in amount of waste collection/delivery is bound to occur due to unavoidable factors like absence of the driver of

vehicle from duty due to ailment or similar other reason, waste collection vehicle requiring repair and maintenance, lack of enough waste along the route thus making it possible to lift the waste in fewer number of trips than those completed routinely in a day etc.

#### 4.3 Quantity of waste per trip

Table 3 shows that more waste per trip on average is carried by vehicles and brought to the disposal site under PBS (3.86 tons) as compared with the conventional system (3.1 tons). In general there is an average increase of around 1 ton of waste per trip indicating a considerable raise in overall efficiency of waste collection and disposal under the new system.

#### 4.4 Cost of lifting waste from collection points and bringing it to disposal site

The data presented in table 4 indicates that overall there is reasonable reduction in cost involved in lifting waste under PBS (at an average of Rs. 145 per ton) as compared with the conventional system (at an average of Rs. 201 per ton) considering the January 2006 rate of diesel, that is Rs. 37.21 per liter. In absolute terms, although the data shows increase in cost of lifting waste under the PBS (chiefly due to rise in price of diesel over the years), it would still be fairly economical if compared with the cost currently incurred under the conventional system. Unfortunately no organized data concerning vehicles operating under conventional system is available unlike the PBS in which case proper record keeping is done on computers on daily basis. But the increasing number of PBS routes is an indicator of this fact that the new system is more cost effective in operational terms thereby providing sufficient justification for the SWMD to keep bringing other routes under the PBS.

#### 4.5 Increase in income of waste lifting staff

One of the chief reasons behind improved efficiency of the operational staff in collection and delivery of waste under the PBS is the financial incentive tied with the amount of waste lifted. Table 5 provides a comparison of income of drivers/helpers of waste collection vehicles under conventional system and PBS for the month of Jan 2006 with that of May 2008. As clear from the said table, there is a significant increase in monthly income of drivers and helpers of all the vehicles under the PBS ranging from 37% to 171% with an average increase of 96%. The financial incentive gained under the PBS is shared by the driver and helper of each vehicle in proportionate with the level of official salaries drawn by their colleagues under the conventional system.

#### 4.6 Cleanliness around collection points

Nazir (2009) notes the difference of cleanliness around the skips (large waste containers) along two PBS and two conventional routes in Lahore. It was observed at the time of survey that most of the containers along conventional routes were brimming with waste while most of those placed along PBS routes were emptied. But cleanliness around skips on PBS routes was only slightly better as compared to situation on conventional routes. This was perhaps due to the fact that most of the containers got over flow daily because of low capacity to accommodate the amount of waste generated thereby leaving the people with no choice but to throw waste around the containers. Scavenging activities also cause spreading of waste around containers but these activities were found low on PBS routes due to regular emptying of waste containers.

#### 5. Concluding Remarks

The analysis of data as presented above clearly indicates that the secondary waste collection service under PBS, which has been initiated by the SWMD of the CDGL to bring improvement, is working efficiently and effectively. The increase in amount of solid waste being brought up to the disposal site, the overall reduction in cost of lifting the waste, and increase in income of the concerned staff of the SWMD, all serve as indicators of improvement in secondary waste collection along PBS routes in Lahore. Maintaining proper record and close monitoring of field staff have further ensured that the waste collection and disposal service under the PBS remains effective. However, the issue of cleanliness around skips needs to be addressed properly to improve aesthetic conditions and prevent scavenging. Similarly, interviews with officials of SWMD revealed that vehicle depreciation of waste collection vehicle due to increased number of trips under the PBS is another issue. This not only requires strengthening of existing workshops of the SWMD but also additional funds to purchase new vehicles which would be needed any way to expand the waste collection and disposal service under the PBS to the remaining towns of Lahore. Purchase of new containers and hiring of additional staff would be other areas of investment to continue effective implementation of the PBS. Another pertinent issue is the shrinking capacity of existing official waste dumping site in the wake of improvement in waste collection efficiency under the PBS (Nazir, 2009). In this context the CDGL would need to find new sites and invest in necessary infrastructure to ensure safe disposal of city waste in future.



**Table 1: Physical Composition of Waste in Lahore**

Sr. No.	Description	Tons per day	% Weight
1	Vegetable & Fruit Residues	1744.5	30.72
2	Paper	153.3	2.70
3	Plastic & Rubber	319.7	5.63
4	Leaves, Grass, Straws etc.	1136.9	20.02
5	Rags	423.0	7.45
6	Wood	70.4	1.24
7	Bones	58.4	1.03
8	Animal Waste	143.6	2.53
9	Glass	39.7	0.70
10	Metals	18.1	0.32
11	Dust, Dirt, Ashes, Stones, Bricks etc.	1570.2	27.65
12	Unclassified	0.56	0.01
<b>Total</b>		<b>5679</b>	<b>100.00</b>

**Source: CDGL, 2008****Table 2: Comparison of waste delivery by selected vehicles under conventional and performance based systems**

Vehicle No.	Waste lifted (tons per month)						
	Conventional system (Jan 2006)	Performance based system					
		May-08	Sep-08	May-09	Sep-09	May-10	Average
<b>Shalimar Town</b>							
A-18	517	1383	647	455	472	809	753
A-71	775	1388	1002	413	947	1141	978
ISA-275	302	912	537	499	541	598	617
ISA-276	379	826	605	535	577	858	680
<b>Aziz Bhatti Town</b>							
ISA-269	270	673	440	368	404	495	476
ISA-286	173	681	291	307	380	496	431
<b>Ravi Town</b>							
A-72	652	836	970	753	755	961	855
ISA-274	315	992	850	707	610	530	738
<b>Gulberg Town</b>							
A-59	610	1201	800	592	497	1025	823
A-64	503	953	477	811	869	1071	836
A-65	325	883	688	689	666	1161	817
A-75	510	990	954	404	585	893	765
ISA-282	246	644	305	342	302	396	398
ISA-298	226	580	396	289	326	395	397
ISA-305	227	780	518	404	363	421	497
Average	402	915	632	505	553	750	671
% age increase	-	128	57	26	38	87	67

**Source: SWMD/CDGL, 2010**

**Table 3: Comparison of waste per trip delivered at disposal site under conventional and performance based systems**

Vehicle No.	Waste per trip (tons)						
	Conventional system (Jan 2006)	Performance based system					
		May-08	Sep-08	May-09	Sep-09	May-10	Average
Shalimar Town							
A-18	3.98	5.22	4.65	4.1	4.46	4.35	4.56
A-71	4.08	5.3	4.57	4.69	4.53	4.58	4.73
ISA-275	2.32	3.36	2.81	2.83	2.66	3.01	2.93
ISA-276	2.11	3.25	3.02	2.84	2.75	3	2.97
Aziz Bhatti Town							
ISA-269	2.97	3.35	3.14	3.04	2.91	2.98	3.08
ISA-286	2.51	3.3	2.91	3.07	2.99	2.97	3.05
Ravi Town							
A-72	4.29	5.43	5.39	5.05	4.9	5.01	5.16
ISA-274	2.23	3.31	3.32	2.95	2.7	2.94	3.04
Gulberg Town							
A-59	4.04	5.41	5.13	5.06	4.6	4.59	4.96
A-64	4.06	5.35	4.38	4.77	4.77	4.63	4.78
A-65	4.01	5.49	5.21	5.18	4.93	5	5.16
A-75	4.18	5.27	4.99	5.25	4.3	4.7	4.90
ISA-282	1.91	3.28	2.75	2.9	2.83	2.97	2.95
ISA-298	1.95	3.28	2.69	2.78	2.67	2.92	2.87
ISA-305	1.8	3.24	2.86	2.63	2.63	2.33	2.74
Average	3.10	4.26	3.85	3.81	3.64	3.73	3.86
% age increase	-	37	25	23	18	21	25

Source: SWMD/CDGL, 2010

**Table 4: Comparison of cost of lifting waste and delivering it at disposal site under conventional and performance based systems**

Vehicle No.	Conven- tional system	Performance based system					
	Cost per ton (Rs)* (Jan 2006)	Cost per ton @ Jan 2006 fuel price per liter (Rs) / Cost per ton @ actual fuel price per liter in respective month (Rs)**					Average
		May 2008	Sept 2008	May 2009	Sept 2009	May 2010	
Shalimar Town							
A-18	116	79 / 106	81 / 145	94 / 145	92 / 164	108 / 224	91 / 157
A-71	120	83 / 112	85 / 152	99 / 151	97 / 174	83 / 173	89 / 152
ISA-275	157	102 / 137	107 / 192	141 / 216	137 / 245	103 / 215	118 / 201
ISA-276	156	108 / 146	115 / 205	150 / 230	147 / 261	126 / 261	129 / 221
Aziz Bhatti Town							
ISA-269	223	149 / 201	159 / 285	206 / 316	202 / 360	143 / 296	172 / 292
ISA-286	319	145 / 196	155 / 277	201 / 308	198 / 353	132 / 275	166 / 282
Ravi Town							
A-72	142	104 / 140	107 / 191	124 / 190	122 / 217	95 / 198	110 / 187
ISA-274	188	132 / 178	141 / 251	182 / 280	179 / 319	131 / 272	153 / 260
Gulberg Town							

A-59	135	106 / 144	110 / 196	127 / 195	125 / 223	75 / 155	109 / 183
A-64	174	135 / 182	147 / 262	161 / 247	159 / 284	91 / 188	139 / 233
A-65	230	159 / 214	165 / 295	189 / 290	187 / 333	106 / 219	161 / 270
A-75	203	138 / 186	143 / 255	156 / 239	163 / 290	106 / 219	141 / 238
ISA-282	273	179 / 242	192 / 344	248 / 380	244 / 435	212 / 441	215 / 368
ISA-298	302	196 / 264	211 / 377	248 / 380	244 / 435	215 / 446	223 / 380
ISA-305	280	149 / 201	159 / 284	183 / 280	179 / 319	145 / 301	163 / 277
Average	201	131 / 177	138 / 247	167 / 256	165 / 294	125 / 259	145 / 247
% age decrease/increase	-	35 / -12	31 / 23	17 / 27	18 / 46	38 / 29	28 / 23

\* Rate of diesel in January 2006 was Rs. 37.21 per liter.

\*\* Rate per liter of diesel was Rs. 50.21 in May 2008, Rs. 66.48 in September 2008, Rs. 57.04 in May 2009, Rs. 66.26 in September 2009, and Rs. 77.19 in May 2010.

Source: SWMD/CDGL, 2010

**Table 5: Comparison of income of drivers of waste disposal vehicles under conventional and performance based systems**

Vehicle No.	Conventional system (Jan 2006)			Performance based system (May 2008)			
	Expenditure (Rs.)	Cost of fuel @ Rs. 37.21 per lit.	Salary of Driver/Helper (Rs.)	Expenditure (Rs.)	Cost of fuel @ Rs. 50.21/lit	Income of Driver/Helper (Rs.)	%age increase in income
<b>Shalimar Town</b>							
A-18	59872	42047	17825	147174	117542	29632	66
A-71	92617	74792	17825	155416	122763	32653	83
ISA-275	47407	29582	17825	124960	85056	39904	124
ISA-276	59314	41489	17825	120708	86060	34648	94
<b>Aziz Bhatti Town</b>							
ISA-269	60244	42419	17825	135171	98412	36759	106
ISA-286	55221	37396	17825	133636	98261	35375	98
<b>Ravi Town</b>							
A-72	92878	75053	17825	117152	92788	24364	37
ISA-274	59314	41489	17825	176336	128036	48300	171
<b>Gulberg Town</b>							
A-59	82198	64373	17825	172490	137475	35015	96
A-64	87780	69955	17825	173720	142998	30722	72
A-65	74756	56931	17825	188937	153592	35345	98
A-75	103594	85769	17825	183979	154195	29784	67
ISA-282	67128	49303	17825	155776	118094	37682	111
ISA-298	68245	50420	17825	153512	117742	35770	101
ISA-305	63593	45768	17825	156738	117994	38744	117
Average	71611	53786	17825	153047	118067	34980	96

Source: SWMD/CDGL, 2010

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## Studying the Possible Impact of Agricultural Audiovisual Programs on Farm Productivity

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**Abstract:** Agricultural extension, which is essentially a message delivery system, has a major role to play in agricultural development. It serves as a source of advice and assistance for farmers to help them improving their production and marketing. The task of extension education is accomplished by different extension methods/media, which may come under individual, group and mass contacts. This paper investigates the possible impact that agricultural audiovisual programs could have on farm productivity. It is indicated that an agricultural information program via a combination of television broadcast and video group screening would be justifiable to the Government is a current agricultural extension activity. The article also assists the authorities in improving an agricultural development system to support current extension activities via audio-visual mass media.

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**Keywords:** Impact, Agriculture, Audiovisual Programs, Farm, Productivity

### 1. Introduction

According to Dowmont (1980) a video recorder is a name given to electronic machinery that plays, makes records, and play back the video film, while videocassette can be defined as a long narrow band of magnetic material in a flat container, on which films can be recorded, whereas a video film- is a film recorded on a videocassette, video disc or digital video disk, and a tool- is a piece of equipment that can be used to do a particular job. There are several ways in which video films can be produced and used within a rural development process. When focusing on production and use, there are top down approach methods where video films are produced elsewhere by development agents. In cases like these the documenting team from other professions i.e. with no agricultural background, document and submit the documented product to change agents. The change agents have to find a way of using the video film produced. These types of videos include the commonly known educational/instructional video films. This approach of documentation can be changed thanks to evolution in digital computer and video equipment. This technological change has brought many changes in the use and role of media for communication in development. The change made video films to be cheaper, more reliable and easier to use, making it accessible to many organizations and to individuals and usable in many different contexts by a wide range of people as identified by Norrish (1999). Supporting this particular change Mody (1991); Melkote, (1991) as cited by Norrish (1999) found that media communication is no longer seen as simply a top-

down flow of information, exemplified by the delivery of messages through the national press, radio and television to agricultural extension services or to mobilize populations behind government development programs (Tomalin,1986). It is now (top-down flow of information) slowly replaced by script less methods of video film production. This method use participatory approaches when documenting video films, for example participatory video. The aim of this article is to outline the importance of producing video films by extension officers with farmers emphasizing production processes as a route-map of following farming processes and activities. The article assists the authorities in improving an agricultural development system to support current extension activities via audio-visual mass media.

### 2. Agricultural extension

Agricultural extension could be considered as a bridge between the scientists and governmental bodies and agricultural practice or farming. Science in this context, is not only understood to be natural science (physics, chemistry, biology) and its applications, but also the branches of knowledge which more directly concern with people and society, such as economics, sociology and cultural anthropology. The term governmental bodies here refer to the whole governmental activities concerning land ownership and tenancy, soil protection, irrigation, transport facilities, labor problems, marketing, rural credit, cooperative and education. All practical" know how" with regard to the results of science and all relevant information ought to be

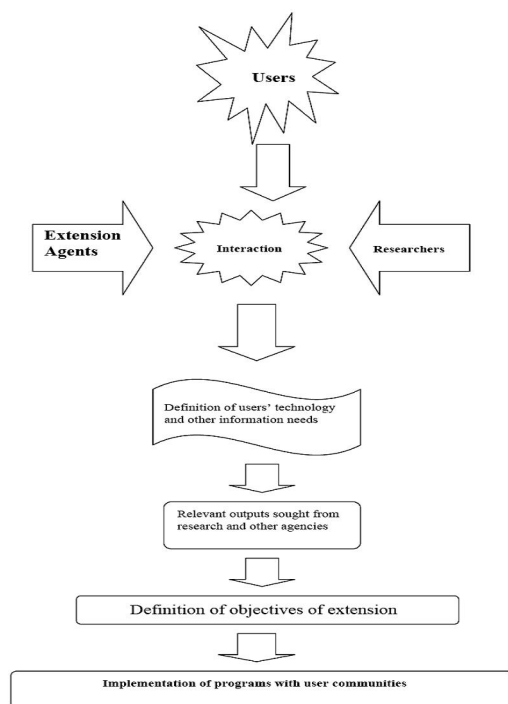


explained to the farm people. But the bridge is not for one way traffic only. The extension agents in the fields should also reflect on the farmers' needs and problems to the agricultural research stations and governmental bodies in question. This implies that the extension agents' approaches and methods will vary according to the level of socioeconomic evolution of the villagers.

### 3. Sustainable Extension Model

Ensuring that information and the systems that support its generation and dissemination are responsive to the needs of those involved in decision-making is one of the crucial parts in an extension system designed to support sustainable development. If we considered this as the left hand of sustainable development extension, then the right hand could be the tools and processes in the extension approach that develop the capacity of players in the information system, and the users of information, to make meaning of it, constructively debate is of great value and contribute to the process development. These two complementary parts are very important for sustainable development extension models; the process is shown by Geer and others (1996). They propose an interdependency approach to extension as seen in (figure 1).

**Figure 1:** Sustainable development extension model



They argue that this model provides for involving stakeholders in defining their needs and setting the goals of the extension program. The

outcomes of this collaborative stakeholder process, provides direction for the development of outputs in the form of research, management strategies and other forms of technology. Once the outputs have been achieved, the objectives of extension programmers are defined and these are then put out into the wider community, often through the more traditional processes of extension such as talks, field days etc., which then eventually lead to some level of implementation.

### 4. Sources of information used in agriculture

In their daily life, people use different types of home grown media. Some are more accessible and affordable, such as rural radio and extension aids, thanks to digital revolution some are now becoming more accessible and reasonable to those families who were unable to access them for instance like the television or videos. The common methods of communicating with rural people include leaflets, newsletters, posters, exhibits, visual aids and radio programs in communicating agricultural information. Each medium has its own specific technical features that make it more or less suitable for specific objectives; target groups, situations and type of message one want to show. Different media strategies will be required for different objectives. The selection of a medium depends mainly on the message and the target. For people with low literacy level print media may hinder the main message that is to be communicated causing hold back of transformation, as transformation, all starts with information and understanding of that information. In the past decade(s), there was a great evolution in agricultural knowledge, methods of training farmers, communication of message and sources of information. The information age and its supporting technologies, such as the Internet and other digital tools, has enabled work and learning to occur during time periods and in locations based upon individual needs. However, the advent of the Internet, and especially the World Wide Web offers unprecedented opportunities for information exchange and knowledge transfer to the lives of rural poor.

### 5. The Importance of video film and television programs in rural areas

Knowledge and access to information are essential for people to respond successfully to the opportunities and challenges of social, economic and technological changes, including those that help to improve agricultural productivity, food security and rural livelihoods. New information in agricultural production will enable rural people to learn about new ways of improving agriculture, and this will help to create a situation where a producer (farmer) will be

a sender not only a receiver and therefore the current provider of information being the extension officer/researcher being a receiver. According to World Bank (1998), access to information is one of the keys for marginalized rural people to improve their ways of living. Women have access to only 10% of agricultural extension programs and if they can manage to have different sources of information in agriculture, they can manage to build their institutions and meet challenges in their everyday lives. The general use of media in agricultural development is to provide information, to sensitize and to reach groups of rural people and also to put into a different and more accessible form actual experience or learning that face-to-face cannot cover anymore. The importance of information is shown by Accascina (2000), when stating that, from different parts of the world, especially in developed countries farmers are benefiting from information technology to get market set ups and subsequently buy seeds at 20% less and sell produce for 20% more by bypassing the middleman. Although the technology may actually only reach a center in the district nearby and the data be carried to village level on paper or by word of mouth, the farmer is still the direct beneficiary of the information itself. As mentioned above, this will totally depend on the access to that particular information by farmers and whether they will manage to read and utilize the information on their hands. Accascina, (2000), further outlined that the information provided in the above statement, such as the price of market goods to farmers, may be valid for only a day, and the relative system may take less to implement. As agricultural information is changing very rapidly, it is imperative to choose a topic that will be used by people (even from different faculties) in a long period of time, for instance instead on dwelling of market price, one may develop information on developing a market or a farmers' group(s).

## 6. Advantages of Video Film and Television Programs

Video films are more advantageous because they can be produced and distributed in a very short period of time. They are also presently readily available for different consumers (cliente) as they are now becoming less expensive- they can be borrowed, and are easy to produce. As video films bring action to the viewers, they become handy when trainers have a difficulty of taking the learners for field trips due to limiting funds or geographic conditions.

a) Availability- As a mass medium, video films can be made quickly and be multiplied, packed and distributed very fast.

b) Video films are visuals and if produced in local language(s), the audience will see and hear the information it contains regardless of their level of literacy.

c) A short sequence from the program can be selected for intensive study- this can be worked first by the extension agent or both agents and farmers.

d) It is possible to stop at any given time to pay special attention to a specific point.

e) Video can aid meaning by showing relevant information in close-up.

f) Consistency- the information on the film is uniform and it can be stored on the main (master) copy and be recorded with no change of quality.

g) Reinforcement- a video film can be used to reinforce the trainer's presentation

## 7. The context of video production

There are several ways used to produce documents with farmers but the aim of this document will focus only on production of video film with and about farmers and using the produced video films to disseminate information to other farmers and extension officers sharing similar contexts. When produced with farmers, video films can be one complex method used by farmers to access information that may touch emotions, be an eye opener and generate reaction from viewers. According to Bosch (2004) this method may be used especially where lots of people cannot read well or have a difficulty of understanding other languages, because video films can be produced using local languages to suit the targeted audience (Gabriel, 2000). Educators who have worked with hundreds of farm families have indicated that farmers are more willing to seek assistance today than they were back in the 1980's and 1990's, although it is not easy to ask for help or access resources. The challenge is always with the extension officers who constantly struggle with the challenge of delivering programs that are effective, timely, and accessible to specific target audiences. To meet this challenge the extension officer should come up with several methods of information delivery and targeting specific people. To manage to produce this type of information, the extension service should bring on board people (farmers) the information is produced for. This is done because communication is no longer seen as a one-way, top-down transfer of messages and information through the media; instead, when applied to development, communication is used to promote a two-way process of sharing and participation. Hence video films may be one of the methods suitable for producing this type of information-with the participation of farmers (Tennessee, 1997).

### 8. Common types of video films used in agriculture for information dissemination

This section of the chapter looked at how different video films produced by agricultural agents from different disciplines are used with farmers. The common video films used are educational, participatory and reconstruction of reality video films. This section focused on giving the background on the use of video as a tool to influence change for development, by focusing on production and using video films produced through reconstruction of reality. Farmers' indigenous agricultural practices offer many answers, and the best of both knowledge areas need to be considered to meet local needs. Agricultural extension is a multidimensional profession that requires an understanding of science, technology, communication, local culture and the role of social relationships in agricultural decision-making. Extension to reach its goals uses tools that are strived to suit people with different numerical and literal levels and among these tools are video films. Jones (Gwyn,1986). Video films as tools in agricultural extension can be used within groups for envisaged change; it does not matter whether the video film is targeting an individual, group(s) or society. Suppose any change agent want to send a message, the agent could pick up a pen and write a note. But if he or she has problems writing or if the recipient has difficulty reading, the agent is not communicating. But when using a video film that is produced with people, groups, or the whole society they can portray what society's needs really are so that their concerns can be addressed focusing at real issues, without the agent writing what he or she thinks can be implemented.

#### Participatory video

Participatory video is defined by Mengi (2000), as a script less video production process, directed by a group of grassroots people, moving forward in iterative cycles of shooting-reviewing, and aiming at creating video narratives that communicate what those who participate in the process really want to communicate, in a way that they think is appropriate (Tieku, 2000).

#### Educational video films

In agriculture, these are video films produced by agricultural scientists directed by video film specialists. They are basically top-down video films produced elsewhere e.g. in environmentally controlled environment (at the experimental farms/site), with high tech plants and or animals by a specialized (video) team concentrating on specific topic- e.g. maize farming- looking after maize. The video specialists make the production and submit it to

the producers who in most cases are agricultural scientists and the scientist will distribute it to extension officers who are expected to project the video to farmers with an objective of teaching them on that selected topic.

### 9. Conclusion

Agricultural Extension is about providing people with objective information. In Asian countries dissemination of this information is done by less specialized extension officers who in most cases concentrate on transfer of technology as delivery method. Farmers can only be empowered if they can access information that relates to their experiences. This type of information can only be gathered when the extension service providers work closely with farmers. Video has been used as a tool to produce information with farmers and disseminate that knowledge to similar people. Knowledge and access to information are essential for people to respond successfully to the opportunities and challenges of social, economic and technological changes, including those that help to improve agricultural productivity, food security and rural livelihoods. Among other methods used in disseminating messages to farmers, video films are becoming a common place as a way to supplement common methods of information transfer. But, many video films used in information transfer still mimic televised or top down methods of transferring information. Visual aids including video films are the tools of teaching through the sense of sight and/or hearing. They are supporting materials and therefore they should be considered only as a tool (aid) that helps disseminate information.

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## Representation of Women's Role in Iranian TV Series

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**Abstract:** The concept of representation has a central aspect in media studies. This concept is closely related to the efforts, which are done to draw reality. Considering the importance of women in the family institution in Islamic Republic of Iran, one of the important tasks of Islamic Republic of Iran Broadcasting (IRIB) is strengthening the women status and improving the levels of community mental health for women. Three decades after the political revolution of 1978, the figure of the woman remains a pivotal point in the Iranian public discourse.

This article endeavors to unravel the dominant gender ideology of Iranian television by decoding one of its popular T.V series. It argues that this T.V series represents Iranian women as 'otherization' of the Western women. Furthermore, it argues that the hegemonic aspect of this T.V series has been able to win the trust of many Iranian viewers. It is theoretically based on the 'theory of discourse' developed by Ernesto Laclau and Chantal Mouffe. The methodologies which have been applied in this study include textual analysis and in-depth interview. In this article the role of women in the most Iranian popular family series of television (Coma with 84/2 percent of viewers) has been evaluated by using content analysis techniques during the first six months of the year 2007.

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**Keywords:** Representation, Women's Role, TV Series, Gender, Media

### 1. Introduction

Traditional/modern representation of Iranian women is one the idiosyncrasies of Iranian society: they have been represented as traditionally Islamic women who are also able to meet the modern social demands. This article makes an attempt to unravel these contradictory elements –such as liberty/motherhood, and to reveal their interactions. From the perspective of cultural anthropology, body image is a rich source of social and cultural signification of the meaning of being human, always gendered always contested. In the words of Nancy Scheper-Hughes and Margaret Lock one needs to approach the body "as simultaneously a physical and symbolic artifact". From this stance, the imposition of compulsory hejab on the body of women speaks volumes to developmental and psychological processes of articulating the contour of the feminine body (Norenee, 1977).

Television is an ideological state apparatus. Its programs are cultural efforts to disseminate a dominant cultural ideology. In this regard, T.V series are efficient tools to 'interpellate' the audiences within a social, political and cultural ideology. Since they deal with social and family relations, they have ample opportunities to address a large audience. The audience does not usually deem these programs as

complete narrations and start to identify with their characters (Pazarzi, &Tsangaris, 2008).

In Iran, T.V series has been a key tool in the representation of the traditional/modern Iranian women's identity; therefore, their decoding (textual analysis) can reveal the dominant representation of Iranian women.

This article pursues two aims: first, to reveal the representation of Iranian women in Iranian popular T.V series; second, to analyse the audiences' interpretations of this representation.

### 2. Methodology

Two methods have been drawn upon in this research: 'textual analyses', and 'encoding/ decoding method'. We have used 'textual analyses in order to reveal the representation of Iranian woman in Iranian TV series, and 'encoding/ decoding method' to analyze the audiences' decoding and their reactions to the representation of Iranian woman in Iranian TV series.

Through the use of 'encoding/decoding method' this article makes an attempt to analyze the discourses which have constituted the audiences' decoding of the content of these T.V series. On the other hand, by combining Laclau and Mouffe's discourse theory and Hall's 'encoding and decoding', it endeavors to reveal the constructive discourses of



these T.V series. Accordingly, this article argues that the producers of these T.V series encode messages which are constituted by the discursive practices of the dominant ideology regarding the representation of Iranian women (Pazarzi, & Tsangaris, 2008).

One of the most popular Iranian T.V Series in 2007 was called "Coma". This T.V series has been selected as a representative case study. The focus group whose reactions to this program have been analyzed is a group of Iranian viewers who represent the more educated class of the society.

### 3. Theoretical Bases

According to Laclau and Mouffe all social phenomena are discursive in that every phenomenon will be devoid of meaning unless it is ascribed to a discourse. Accordingly, a discourse is understood as the fixation of meaning within a particular domain. All signs in a discourse are 'moments'. Therefore, a discourse is formed by the partial fixation of meaning around certain nodal points. Both Stuart Hall's theory of representation, based on Gramsci's concept of hegemony, and Laclau and Mouffe's discourse theory emphasize the prominent role of mass media in the construction of the dominant ideology. Hall (1975, 1980) argues that mass media, especially television, plays a special role in the buttressing of the dominant ideology due to its popular use of language and allegation as being the representative of the majority (Hall, S. 2003).

According to Laclau and Mouffe (2002), T.V Series are a type discourse. They are a total structure; they include entities which have been ascribed with fixed identities and meanings. Through this type of representation they endeavor to express the universality of their meanings. Like discourse, they make an attempt to persuade the audiences to accept a dominant ideology as natural and to provide power with legitimacy. However, the audiences may resist it since they have been surrounded by other discourses as well (Creswell, 2007).

#### **Iranian T.V Series Analyses**

Iranian T.V series called "Coma" was broadcasted in 28 episodes in 2007. The story of this T.V series is based on dissemination of gender ideology with a series of binary opposition. As follows; four cinematic moments have been selected to further illustrate the concepts represented in "Coma" T.V series:

#### **The reduction of the body to the facial**

One of the most noticeable physical features of people in "Coma" was their face. For women in Islamic Republic, the details of their facial anatomy and design have become a public obsession. Tehran,

the mega-capital city of the country is reportedly the number one urban space in global statistics of cosmetic Rhinoplasty. Once prohibited by cultural norms – or today's young people in Tehran openly speak about their own cosmetic facial surgeries and proudly name their city as the number one capital of nose job. In T.V, finding an "un-adulterated" face, as it is often referred to by the filmmaker, is an increasingly difficult task. Only in recent decade, the independent filmmakers with considerable social and intellectual clout such as Beyzai, Kiarostami, Panahi, and Hatami-Kia have made a concerted effort to casting the "natural" face. The usual explanation given by the directors for their selectiveness is to overcome the futility of cosmetic trends in their pursuit for an authentic representation of life in Iran. Bahram Beyzai, an outspoken pro-feminist filmmaker of close to forty years, whose theatrical professional repertoire is no less impressive than his extensive cinematic productions, often uses his real life wife, Mojdeh Shamsai to play the prime role (Barker, 2003).

Caught between two extreme models of beauty, the Iranian woman perceives her body to be first reduced to the shape and proportions of her face, and second is taught to choose either a Western ideal of beauty that deems her own facial characteristics as less than desirable, or to react by adopting a moralistic rhetoric to justify her non-participation in the trend. As such, she ceases to be impartial or confident about her body.

#### **Frail grannies, fragile finches**

In a societal setting that is obsessed with the feminine body, either in its governmental systematic effort to cover and control the female body, or the reactive indulgence in cosmetic alterations to the body by women (young and mature) the vast majority of women become invisible. What remains visible is an oppositional set of profiles built on the idea of the woman as an embodiment of the heterosexual man's desire. In simpler words, women are either sexually available thus desirable by men (the girlfriend, the wife) or they remain outside the realm of sexuality (the familiar and the familial such as the mother, the sister, and the grandma). In the past decade or so, a popular slang term about the body of the desired woman has emerged in Iran's oral culture, which is popular among men and women alike. Named after a very small-bodied bird that resembles a less mature embodiment yet with better singing qualities and in a more colorful version of the otherwise common sparrow, *The Finch* became the term to identify feminine beauty. The ideal girlfriend is a Finch whose beauty rests in her petite (read fragile) body and colorful entertaining behavior (Derrida, 1979).

### The profiling of the female voice

Another subtle extension of the body image in “Coma” T.V series comes through the profiling of the female voice. The State Television and Radio programs have severely caricatured the voice of the woman into a handful of stereotypical categories. The women on these programs are profiled both in their physical appearances (their body shapes, size, clothes and make up) as well as their aural representations. The vocal expression of the woman on the radio where the voice matters most- is primarily limited to one of the two profiles: that of a depleted pious auditory of a saintly grandmother or else the forcefully paced and overly enunciated voice of a religious poetess (Dines & Humez, 1994).

On television and popular cinema, however, the possibilities for the woman's voice expands to include even more exaggerated forms ranging from, faux infantile speech often with a fake lisp and high pitched tones, to the shrill and angry piercings of a nagging wife. These extreme models of feminine vocal articulations are frequently adopted by young women and are greatly accepted and strongly popular in Iran. Most notably is the popularization of these oral castings through cartoon characters that reach a considerable span of popularity on television before they are adopted into a full feature film. As a result, one will hear millions of young adults (boys and girls, although by far more females are expected to play this game) imitating the voice over for puppet characters such as the infamous Kolah Ghermezi, when relating to friends and or lovers.

While the practice of trend-seeking and oral and bodily imitation is neither unique nor new to Iranian women (e.g. Japanese hyper model of femininity, or the Hannah Montana effect in the USA) it does, however, set the foundation for heterosexual and overly exaggerated femininity that re-emphasizes misogynistic view of women (Gledhill, 1988).

### The “real” beauty: weaving through theory and the concrete

In his re-reading of Freudian psychoanalysis, Jacques Lacan distinguishes between the “imaginary order” and the “symbolic”, so that the imaginary is chaotic and disorderly while the symbolic representation illustrates thought and careful organizational techniques at work (1968). Lacan offers this distinction in order to locate the way we experience reality. His conclusion is that “the real” sits somewhere in between the symbolic order (i.e. society) and the imaginary representation of it. Much of the International success of the Iranian new-wave cinema in the past decade, I believe, is due to achieving an alternative order of reality about life in

Iran that oscillates between the symbolic, the imaginary, and the real representation of life. As such, this movement back and forth between poles of exaggerated imageries and contested sensibilities has revolutionized cinematic productions in Iran. More relevant to the scope of this paper, however, it has expanded the range of possibilities for human existence, especially with respect to the woman's body in a politically heightened time. (Laclau & Moufee, 1985).

The body of the woman in “Coma” T.V series, on the one hand, is at the foreground of domestic gender moralities, and on the other hand, it provokes fierce International politics that projects Iran as the least rational and most violent tyrannical “other” to the whole of the Western civilization (e.g. American democracy, women's liberation, social justice, etc.).

Body tattoos, un-supervised extreme diet regimes, cosmetic surgeries, mass consumptions of un-regulated diet pills and thinning creams, are among a few widely available and dangerously popular practices that women subject themselves to in order to obtain the perfect body. The normative conception of beauty is far from being heterogeneous or at least free of overtly “racialized” imagining. However, as the idealized image of the body and hetero-sexually normative figure of a beautiful woman stretches beyond geo-political and socio-economical boundaries, the role of visual production in its casting of female models and roles becomes more potent- symbolically and politically. In this light, the evolving cinematic body of work that has dominated the independent production in Iran and about Iran plays an important role in challenging hegemonic super-imposed standards of femininity and beauty (Van Dijk, 1993).

### 4. Conclusion and Discussions

According to the ideological function of mass-media, what which is of great concern for the encoders of T.V series are positive and negative roles of women. The features of women with positive roles are: covered, academically educated and satisfied with the role of being a mother and housewife. They are working women with religious and traditional inclination, and have a great respect for their husbands and are dependent on them. On the contrary, women with negative roles have the following features: first, they are alienated in that they are not able to make a good relation with people around them (who have been trapped in the contradiction between modern and traditional); second, they are against the traditional roles of women in Iranian society: they are against patriarchy and as a result are rejected by society and family. The polarization made in this T.V series serves the dominant discourse of ‘otherization’.

The context has two poles: a positive pole (women in traditional role) that represents us and a negative pole (intellectual woman) representing them or 'others'.

This T.V series implicitly wants to separate the education and employment from modern women's specifications and to articulate them as discursive practices that constitute traditional- religious women's identity. Thus legitimate women are educated, religious, employed, obedient, moral, and pliant to their roles as mothers. The dominant discourse of this series creates a nodal point around which signs such as veil, values, tradition, loyalty, motherhood, education and economic independence (which is borrowed from a Western discourse) are fastened to each other to create a dominant representation which strike cords with the majority of audiences.

Results of in-depth interviews show that seven viewers out of seventeen have decoded this series under the influence of the dominant ideology. These viewers had great religious tendencies with a fairly low level intellectuality. They confirmed the series' figurative space as an ideal one and the women in it as perfect women.

Confirming the cultural/social messages of the series including loyalty to the family institution, motherhood, deeming the representation of contemporary women and men in Iran as natural is the feature of this group of viewers.

Adjusted and operated (compromised) decoding belongs to second group of the viewers that have a medium level of intellectuality and religious tendencies. Although this group including four viewers accepted the gender roles constituted in the series as natural, they argued that the motherhood should be the main role of women; however, they believed that this role was not at loggerheads with the economic independence and employment of women. Moreover, they criticized the producers of this series for their lack of technical mastery.

The third group included six viewers who decoded the series oppositely. The level of their religious tendencies was low, but their level of intellectuality was medium and high. They were aware of the ideas which had been promulgated by the series and argued that these kinds of series were watched by a special group of Iranian society who are generally benefiting from them. They opposed the religious and traditional bigotry and reacted negatively to the dominant moral advice of it. They criticized its producers for their efforts to introduce and represent Iranian women as adhering to patriarchal view points. Therefore, they translated the

important contextual elements so oppositely that they deconstructed the dominant ideology hidden inside it.

The results of in-depth interviews revealed that among the important variables including social /cultural base and religious beliefs which formed the audiences' interpretations, the former one was the most effective variable. Although entering university can be an opportunity for viewers to be exposed to a vast area of information and other discursive practices which can result in fundamental changes in their behaviors and viewpoints, religion still has the main role in the constitution of their mentalities.

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## Semantic processing of Arabic language

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**Abstract:** In spite of the fact that Arabic offers a well-studied theoretical and historical linguistic knowledge, unfortunately, it has so far received very little computational research and in particular on the level of logical compositional analysis. Furthermore representing Arabic sentences as logic programs has the facility of performing some semantic reasoning tasks on a code based on Arabic predicates. This work is therefore attempting to fill some essential aspects of this gap in introducing a logic-based compositional model covering fundamental issues involved in semantic analysis of Arabic sentences. The focus of attention is relying on studying the compositionality of important Arabic syntactical constituents and on extending the concept of the generalized natural language quantification to Generalized Arabic Quantifiers GAQ utilizing lambda-calculus and the type theoretical analysis of Arabic structure. Since semantic representation has to be compositional in natural language understanding systems this approach attempts to propose an element framework for developing more practical and intelligent Arabic natural language processing systems.

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**Keywords:** Semantic Processing; Arabic Language; Literature, Formalization, Verbs.

### 1. Introduction

For the last three decades, concentration on Arabic Language Processing has been focused on the processing of the structure of the language from the morphological and syntactical points of view, whereas research on *computational Semantics* has largely been neglected by Arabic and international computational communities (Mastenbroek, 1994). However, developing natural language understanding systems considering Arabic requires a differentiated and deep semantic processing. This work addresses issues involved in semantic analysis of Arabic and attempts to put fundamentals for the semantic representation in presenting a computational semantic model for Arabic. In the next sections, based on Arabic syntactical constituents utilizing  $\lambda$ -calculus and type theoretical analysis of Arabic structure, a semantic model for constructing *meaning representation* of Arabic sentences, will be presented. In addition, this paper is proposing to apply the Generalized Natural Language Quantification concept to *Generalized Arabic Quantifiers*, "GAQ" to capture the specific nature of Arabic semantic compositionality (Beesley, 2001).

### 2. Literature Review

Semantic processing of human languages is a problematic issue of natural language processing. Artificial Intelligence had a long time ago recognized the importance of semantic representation in context of performing some semantic inferences to achieve human language understanding. Unfortunately,

despite the significance of this issue, semantic processing based on logical models in the case of Arabic has so far received very little research attention (Chalabi, 2004). Meanwhile, many Arabic morphological analyzers have been successful in solving morphology related issues and many others. Arabic syntax has also been addressed by some researchers, but to some extent and some success has as well been achieved there and others. On the other hand, there were few works reported on the knowledge representation and on the computational semantic of Arabic. Most of the reported works treated this problem informally and from the outside. Semantic analysis and in particular, the problem of the *compositionality* of Arabic has so far not been treated deeply enough, neither linguistically nor logically (Ditters, 2001).

One of the main factors for this negligence might reside in the complexity of this field and in the invisible collaboration between scientists working in the field of Artificial Intelligence, Arabic, Logic and Linguistics. Therefore, there is a critical need to design sufficient models for semantic processing of Arabic. In spite of the fact, that so far no existing formal theory of semantics is able to provide a complete and consistent account of all phenomena of Arabic and the natural language in general, it remains beneficial to develop models for semantic processing of Arabic even if such models are imperfect or incomplete. Semantic processing has to accomplish different necessary semantic tasks in interrelated and sometimes interchangeable levels to achieve the



understanding capability: semantic composition, semantic resolution, and semantic evaluation. *Semantic composition* can be viewed as the process of construction of meaning representation for capturing the *semantic potential* of Arabic sentences. Semantic resolution and semantic evaluation are more concerned with disambiguation under using context knowledge and scoping rules and extracting of relevant information based on performing some deductions and inferences on the semantic representation of a proposition. This work will focus the attention on the fundamentals involved in the *compositionality* of Arabic elementary syntactical constituents and their meaning as a departure point towards developing a potential comprehensive computational semantic for Arabi (Dessouk,1987).

### 3. Characteristics of the Arabic Language

The Arabic language can be classified into three types: Classical Arabic, Modern Standard Arabic and Colloquial Arabic Dialects. In this paper, we only consider Classical and Modern Standard Arabic and this will be referred to as “the Arabic Language”. The Arabic language is composed of nouns, verbs and particles. Nouns and verbs are morphemes and derived from a closed set of around 10,000 roots. Particles are used to complete the meaning of verbs and nouns. The roots are commonly of three or four letters, referred to as triliteral and tetraliteral roots, respectively. Arabic nouns and verbs are derived from roots by applying templates to generate stems and then introducing prefixes and suffixes. It was reported by ElKateb *et al.*, that “85% of Arabic words are derived from triliteral roots”. The Arabic verb is any word that indicates the occurrence of an action that is associated with time. An Arabic verb will have a voice (active or passive), a tense (past, present, imperative), a gender (feminine, masculine) and a number (singular, dual, plural). The derivation of the verbs in the different tenses is achieved using well-behaved morphological rules using Eq. (1).

$$\text{Verb} = \text{Prefix1} + \text{Prefix2} + \text{stem} + \text{Suffix1} + \text{Suffix2} + \text{Suffix3}. (1)$$

The stem is formed by substituting the characters of the root into certain verb forms, called measures. Arabic verbs can be classified based on the type of the characters forming their root as this will influence their conjugation and the forms of their derivations. Hence, we distinguish two major classes: sound and weak verbs. (Kamp and Reyle, 1993) Sound verbs are verbs whose root does not contain weak letters (i.e. alef (ا), waw (و), or yaa (ي)); weak verbs are those whose root contains one or

more weak letter. The work reported in this paper concerns only derivations from sound verbs.

The measure (also referred to as form or pattern) is defined in as: “a general mould composed of an ordered sequence of characters”. There are 37 measures for the triliteral and tetraliteral verbs. Arabic grammarians modeled the formation of nouns and verbs and their derivatives based on the concept of root. This root is a set of the three consonants f ‘l (فعل) expressing the idea of the action ‘to act’ (Montague, 1988). For example, the three consonants k t b (كتب) expresses the notion of writing and so on. The root is not part of the language; however, to best represent this root Arab grammarians often use the third person masculine in the past tense of a verb. This is similar in meaning to the infinitive mood in English or French languages. The verb kataba (كتب) (To write) is derived from the root “ktb” and scaled

to fa’ala (فعل). All verbs have a measure which not only provide morphological information, but in many cases also provide semantic and contextual knowledge. Hence, certain measures can state that the action is performed only once, or performed with some intention etc. Examples showing some of this semantic knowledge will be described later. It is therefore, desirable to define a model to represent the Arabic language that not only models the morphology, but also uses this as the primary source for semantic and contextual knowledge. Hence, in this research, we attempt to use the derivations and their measures to structure the Arabic language and to strongly link the words’ morphology to their semantics. This representation is modeled as an ontology. In the following section, we describe the various derivations by providing their measures and then develop the corresponding part of the ontology structure (Black and et al, 2006).

### 4. Derived verbs

There are two types of verbs in the Ontology, triliteral verbs and tetraliteral verbs. Each triliteral verb will have a set of first stem triliteral derived verbs and a set of first stem tetraliteral verbs.

The first stem triliteral and tetraliteral verbs are as follow:

Triliteral verbs have the following first stem derivations measures:

(فعل / فعل / فعل).

Tetraliteral verbs have only one first stem measure which is represented as:

فعل.

From these basic forms, many derivatives are produced based on the number of consonants in the verb. The derivation is composed of the basic



consonants in the root (three or four characters) to which we add one or more consonants (Friedman-Hill, 2003).

### 5. Reasons to Choose a Logical Semantic Representation of the Language

There are many reasons to choose a logical language as a target language for the meaning representation. Logic represents a well-known meaning representation formalism that differentiates between syntax and semantics. In addition, it enables inferences over quantified descriptions, which are basic requirements for an adequate meaning representation for any natural language. On the other hand, in spite of the fact that Arabic offers a well-studied theoretical and historical linguistic knowledge, unfortunately, it has so far received very little computational research and in particular on the level of logical compositional analysis. Furthermore representing Arabic sentences as logic programs has the facility of performing some semantic reasoning tasks on a code based on Arabic predicates. Therefore, it is to be expected, that embedding logical formulas with Arabic predicates is a very interesting aspect of logic programming in the context of understanding Arabic. Unfortunately, Arabic NLP researchers have widely neglected this aspect in their published research works.

As Arabic syntax is based on verb-noun in VS, and on *noun-noun* opposition in NS, a semantic correspondence between Arabic sentences and the first order predicate logic, PLI, formulas can be established. The verb as the head of an Arabic Verbal Sentence, and its complements, or the *خبر* / خبر /; i.e. the nominal predicate as the head of an Arabic Nominal Sentence, can be assigned to a *predicate argument-structure* of the corresponding PLI formula. An Arabic Nominal Sentence can be expressed by using constants or by using quantified arguments of some predicates identifying the role of the subject or the object and other semantic roles.

To interpret logical formulas model theoretically, an *indirect denotation* function is needed to transform higher order logical formulas into PLI. For simplification  $[\alpha]_{sem}$  is used to denote the *semantic function* of an Arabic syntactical structure " " such as a feature structure. As this approach is proceeding from the perspective, that Arabic syntactical constituents are able to exhibit relevant compositional *rules* to construct a semantic representation for the most important Arabic sentence structures, the denotation  $[\alpha]_{sem}$  also has to be *compositional* (Elkateb, 2006).

### Logical forms

On the lexical level, an interpretation process might need some conceptual knowledge and some pragmatic contents in form of lexical semantic knowledge or rules to supplement the meaning and to explain the possible word sense potentials of some Arabic natural propositions in a specific domain. For example, interpreting of concepts like some events such (*تعلم* /, learn-he-it<sup>a</sup>) might need some lexical semantic knowledge and pragmatic annotations about their mode, involved objects and their roles, complements, compositional structure and time. This knowledge base can be viewed as kind of a terminology or an ontology describing the involved events and their deep thematic roles including their compositionality encoded in the lexicon. For example, Arabic verbs are *intransitive*, *transitive*, or *di-transitive* and therefore, their current argument structure might depend on their contextual interpretation.

### 6. Definite, Indefinite and Dual

Video The Arabic article (*ال* /, The) can be understood as a *determiner*. Determiners are modifiers, which together with nouns or noun phrases build expressions, whose reference can be determined with respect to the referent in a direct way. In the standard analysis of determiners in the type theory an article can be considered as a determiner. Determiners are generally of type  $\langle\langle e, t \rangle, \langle\langle e, t \rangle, t \rangle\rangle$ . Such a type can be expressed using A.-calculus to produce compositional rules for Arabic sentences. In contrast, this view cannot be applied to all Arabic determiner particles directly and in all contexts. The article (*ال* /, The) as a logical determiner needs sometimes to be considered in context of some noun phrases. For example, a particle of demonstrative together with the (*ال* /) article in (*هذا-ال-كتاب* /, this-the-book) can be regarded as a logical determiner (Friedman-Hill, 2003).

### 7. Formalization of the Language

For the Arabic language to play an important role in this information age, and for the practical applications directly related to the language to be developed to exploit the large amount of information available in resources such as the WWW, there is a need for a proper formalism for the language that is based on the Arabic Language structure and rules governing the formation of its vocabulary. In this section we develop the proposed model which is based first on structuring the Arabic language into a set of equivalent classes and then model each equivalent class as ontology. Hence, a Meta-Ontology that represents the general structures of all

these classes is presented (El-Sadany and Hashish, 1989).

### 8. Logical sentence structures

As mentioned above, Arabic differentiates between different types of sentences:

*Verbal Sentences (VS), Nominal Sentences (NS) and Copulative Sentences.*

On the contrary to European languages, a Verbal Sentence usually starts with a verb, and in most cases has a V-S-O structure. The predicate of a NS usually is a noun, a pronoun, a propositional phrase or an adverb (Gasevic and et. al, 2006). The predicate of VS is a verb and its complements. Copulative sentences have a Nominal Sentence or a Verbal Sentence as a predicate that is bound with the subject through a copulative pronoun.

### 9. Conclusion

Although, in the Arabic language, triliteral verbs are derived from verbal nouns (مَصْنُوع), their complexity, different variations and lack of logical structures makes them extremely difficult to use as the root for deriving verbs. As this study shows, we did find it much easier to derive from verbs as the list of Arabic verbs is known and is finite (countable).

Meanwhile, this work attempted to present some results of a compositional model for logic based semantic representation of Arabic sentences. In this context, this paper has stressed the concept of the Generalized Arabic Quantifiers "GAQ", some potential analysis of state of definite and indefinite in Arabic within different types of Arabic sentences considering the order of words, cardinality, duality, and the meaning of some syntactical constituents. Interestingly, the gathered experiences with this model give strong indications confirming the view that logic based semantic representation for Arabic offers a vital compositionality methodology, which exhibits important logical similarity to the Indo-European languages. As Arabic has received very little computational research on the level of deep semantic analysis, this contribution might encourage some computational linguists and researchers to put more efforts in this complex area of Arabic natural language understanding. In spite of the fact, that so far no existing formal theory of semantics is able to provide a complete and consistent account of all the phenomena of Arabic, it remains beneficial to develop models for semantic processing of Arabic even if such models seem to be incomplete. Currently, I am working on extending this model in considering other semantic phenomena such as resolving some ambiguity and embedding Discourse Representation Theory as a departure point to capture Arabic discourses and features involved in anaphora

representations in form of a A-DRT within a Unification based Grammar for Arabic.

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## Identification of the Gaseous Zone Origins in Talkhab Area, Markazi Province, Iran

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**Abstract:** This paper aims to determine the emission gaseous the Talkhab fault in Farahan (the Iranian village zone locating in (35 Km) north of Arak city). This area is situated at the boundary of the central Iran and Sanandaj–Sirjan zones. A method is described for the analysis of sulphur dioxide, a major contributor to air pollution on absorbing bottle equipped with a fritted glass bubbler. The sample is collected in a dilute solution of H<sub>2</sub>O<sub>2</sub> and analyzed as sulphate. The resultant acid is determined by acid-base titration. Base on chemical and geological studies liberated gas is SO<sub>2</sub>. This gas liberated by dissolution of litho logic units containing SO<sub>4</sub><sup>2-</sup> ions by groundwater near the Talkhab fault.

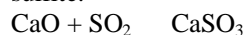
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<http://www.americanscience.org>.

**Keywords:** Air sampling, Sulphur dioxide, Talkhab, Geology

### 1. Introduction

Sulfur dioxide (also sulphur dioxide) is the chemical compound with the formula SO<sub>2</sub>. It is produced by volcanoes and in various industrial processes. Since coal and petroleum often contain sulfur compounds, their combustion generates sulfur dioxide unless the sulfur compounds are removed before burning the fuel. Further oxidation of SO<sub>2</sub>, usually in the presence of a catalyst such as NO<sub>2</sub>, forms H<sub>2</sub>SO<sub>4</sub>, and thus acid rain.<sup>[2]</sup> Sulfur dioxide emissions are also a precursor to particulates in the atmosphere. Both of these impacts are cause for concern over the environmental impact of these fuels. Sulphur dioxide is a major atmospheric pollutant and contributor to acid rain. Sulfur dioxide is a noticeable component in the atmosphere, especially following volcanic eruptions. Sulfur dioxide is a major air pollutant and has significant impacts upon human health. In addition the concentration of sulfur dioxide in the atmosphere can influence the habitat suitability for plant communities as well as animal life. Sulfur dioxide emissions are a precursor to acid rain and atmospheric particulates. Due largely to the US EPA's Acid Rain Program, the U.S. has witnessed a 33 percent decrease in emissions between 1983 and 2002. This improvement resulted in part from flue gas desulfurization, a technology that enables SO<sub>2</sub> to be chemically bound in power plants burning sulfur-containing coal or oil. In particular, calcium oxide (lime) reacts with sulfur dioxide to form calcium sulfite:



Aerobic oxidation of the CaSO<sub>3</sub> gives CaSO<sub>4</sub>, anhydrite. Most gypsum sold in Europe comes from flue gas desulfurization. Sulfur can be removed from coal during the burning process by using limestone as a bed material in Fluidized bed combustion. Sulfur can also be removed from fuels prior to burning the fuel. This prevents the formation of SO<sub>2</sub> because there is no sulfur in the fuel from which SO<sub>2</sub> can be formed. The Claus process is used in refineries to produce sulfur as a byproduct. The Stretford process has also been used to remove sulfur from fuel. Re-Dox processes using iron oxides can also be used, for example, Lo-Cat or Sulferox. Fuel additives, such as calcium additives and magnesium oxide, are being used in gasoline and diesel engines in order to lower the emission of sulfur dioxide gases into the atmosphere.

Sulphur dioxide also gives Intervenal and blade damage in vegetation. It causes broncho constriction in both asthmatic And normal individuals of SO<sub>2</sub> are significantly associated with hospital admissions for respiratory conditions and asthma. The presence of SO<sub>2</sub> in polluted air has an enormous impact on acid rain and acidification of water resources. The standard method to measure SO<sub>2</sub> Is absorption in hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) solution to form sulphuric acid the resultant acid. The resultant acid is determined by acid-base titration. However, the result is subject to interference from other gaseous, acidic or basic compounds such as nitric acid and ammonia, respectively [1].

This paper describes a method for determination of gaseous sulphur dioxide concentration is adsorbed in dilute H<sub>2</sub>O<sub>2</sub> and



recognize the reasons of subject presence by accesses information.

## 2. Geologic setting

Determination of emission gaseous the Talkhab of village zone Farahan in 35 Km north of Arak in the Iran. The area of study is a part of Arak watershed located in the two Central-Iran and Sanandaj-Sirjan Zones. A simplified geological map of Arak area is shown in Fig. 1. The presence of folded mountains and pressure ridges are the main characteristics of this region. Two parallel faults named Talkhab and Tabarteh Faults pass through the region and divide it in to three blocks. These blocks are “Ashtian-Naragh” (ANB), “Haftad-Gholeh” (HGB) and “Sanandaj-Sirjan” Blocks (SSB). The Talkhab Fault separates ANB from HGB while Tabarteh Fault separates HGB from SSB. The amount of water discharge in HGB, SSB and ANB are different and decrease respectively. Talkhab and Tabarteh Faults control the seismicity of the region. [4].

Talkhab spring, travertine and the emanation of gas from some wells are the reasons indicating the activity of Talkhab Fault in Quaternary. Statistical analysis regarding the hypocenters of earthquakes shows that most of the events are located near Talkhab Fault. The oldest block in this region is SSB which involves crystallized limestones, slates from the Jurassic to cretaceous period that underwent faulting and metamorphism without any volcanic activity. The HGB contains shale, Jurassic sandstones and cretaceous limestone with no metamorphism but severely folded and has a sequence of anticline and syncline without any volcanism. [5]

This area is located at the boundary of the central Iran and Sanandaj–Sirjan zones. The Thalkhab and Tabarteh Faults are in the study area (Emami, 1991). The Meighan depression is divided into three subzones by the Thalkhab and Tabarteh Faults: the Sanandaj–Sirjan, Haftedgolleh, and Urmia–Bazman subzones (Fig. 2). Almost of geologic units are Mesozoic and Cenozoic (Fig.1).

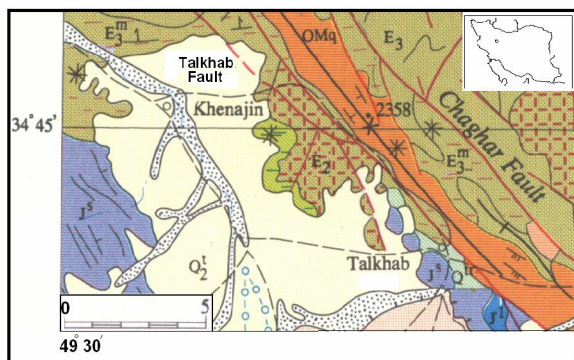


Fig 1a: Geologic setting of study area [3].

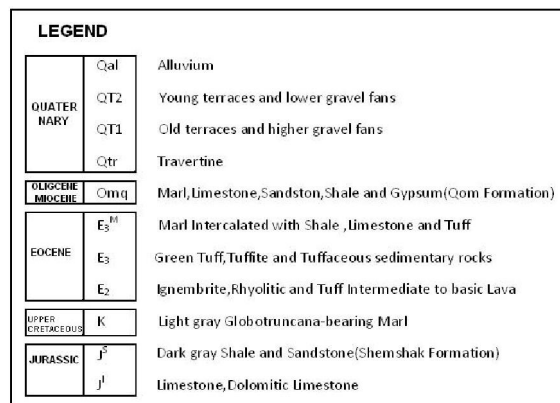


Fig.1b) A simplified geological map of Arak and adjacent areas illustrating the major geologic and tectonic features. Location of the MT sites and Talkhab and Tabarteh faults are also shown on the map. [6]

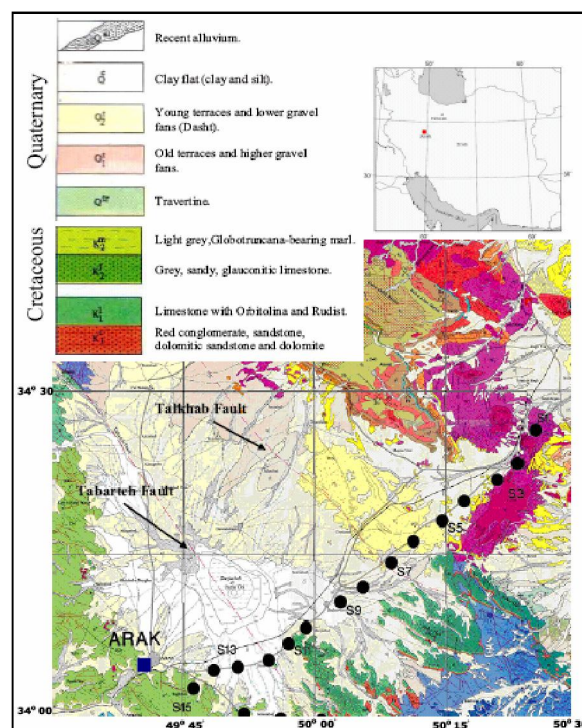
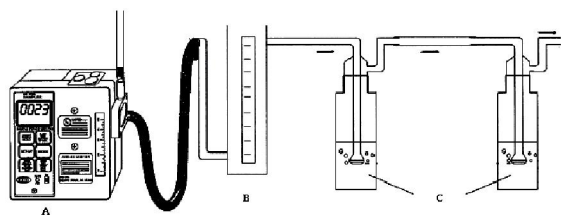


Fig.2. Absorbing bottles sampling system. A) Low flow personal air sampler skc. B) Flow meter. C) Absorbing solutions.

The Thalkhab Fault has a northwest–southeast strike and a northeast dip. Qom and Karaj Formations in Urmia subzone have thrust onto ancient Quaternary terraces. The Jurassic sequence



and Karaj Formation are southwest of the Talkhab Fault.



### 3. Methodology

#### Apparatus

Air samplers were performed using a low flow personal skc and a portable electrochemical Emission analyzer (TESTO 350).

#### Reagents

All chemicals ( $\text{H}_2\text{O}_2$  and  $\text{NaOH}$ ) were reagent-grade materials, from E.Merck these chemicals were used without further purification.

#### Air sampling

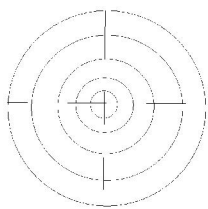
The gases including  $\text{CO}_2$ ,  $\text{NO}_2$  and  $\text{SO}_2$  were measured directly by a portable electrochemical

Emission analyzer (TESTO 350), in such analyzers, the analytical range for each gas

Component is determined by the electrochemical cell design, while the minimum detectable

Limit depends on the nominal range of the electrochemical cell, calibration drift, and signal – to-noise ratio of the measurement system. No detected gases  $\text{NO}_2$  and  $\text{CO}_2$  by portable electrochemical

But gas  $\text{SO}_2$  is determined, the study area (about  $25 \text{ m}^2$ ).

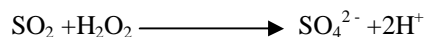


The first system was based on collecting a gas sample into two serial absorbing bottles (fig.2).

The gas washing bottles were made of glass and equipped with a fritted glass bubbler. Two absorption bottles were used to check the collection efficiency of the system. The flow meter had a range of 100-200 ml/min.

Sampling was performed using constant flow-rate. Both bottles contained 75 ml of 0.3% (v/v)

$\text{H}_2\text{O}_2$ . no sulphate was found in the second absorption bottles, indicating near 100% absorption. Efficiency in the first absorbing bottles as  $\text{H}_2\text{O}_2$  was used in the absorbing solution sulphate was detected on the basis of the following reaction.



### 4. Results and discussion

High sensitivity is needed system used for the low level atmospheric pollution measurements, Determination of sulphur dioxide by  $\text{H}_2\text{O}_2$  solution in an absorbing bottle, has been demonstrated. in this study, the emission gases sulphur dioxide released from Talkhab of village zone Farahan in 20 Km north of Arak in the Iran is determined. According to chemical analyses and field geology information, gases origin are present of litho logic units containing  $\text{SO}_4^{2-}$  ions and the Talkhab fault activities. Groundwaters dissolve litho logic units containing  $\text{SO}_4^{2-}$  ions and finally liberate  $\text{SO}_2$ .

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## GIS Based Considerations for Development in Different Iranian Climatic Regions

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**Abstract:** In order to develop a climate model for Iran, monthly mean climatic variables from 117 synoptic stations were obtained from the Iranian Meteorological Organization. These variables were reduced to six orthogonal factors using factor analysis. The stations were then divided into six groups using cluster analysis. Within each climatic group, the lowest and highest thresholds for each factor were identified. The factor scores of the stations within each factor were interpolated across the country applying Inverse Squared Distance Weight in the ArcGIS environment. Based on the factor scores, six conditional functions were defined to allocate each pixel to a region. In order to simplify the models, one index variable was substituted for each factor. Then, through Discriminant Analysis, the constants and coefficients of the models were determined. The final models were evaluated against some examples, one of which, Yazd, was demonstrated fully.

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<http://www.americanscience.org>.

**Keywords:** GIS, Climatic Regions Iranian Meteorological Organization, ArcGIS

### 1. Introduction

The complex physical conditions of Iran including topography, vegetation cover and landscape have created a diverse climate pattern. The very hot and dry climate of the interior areas changes suddenly to the wet and moderate coastal climates of the Caspian coastal areas to the north of the Alborz mountains. The cold climates of Zagros are replaced by the warm desert climates to the east. If we accept that the climate is a very important factor in the development and progress of the country, it is important that it should be recognized and understood in any planning and policy decisions (Shie,1994). Climate is the long time prevailing synoptic conditions of an area, which is composed of different meteorological elements such as temperature, precipitation, humidity, etc. In order to understand it, all meteorological elements should be summarized statistically over time. This means processing huge amounts of data. Planners cannot develop a separate program for each individual weather station and it is therefore the task of the climatologists to classify weather stations and to identify climatic regions. Many studies have been conducted on this subject during the first half of the 20th century. Different models were developed by established climatologists such as Koeppen and De Martonne. These models use few weather variables and lack the totality of the climate. Due to some shortcomings inherent in these models, new multivariate models have been developed following the introduction of computers. The work of Fovell and Fovell (1993) is one of the basic and fundamental studies in using clustering to

identify the climatic regions of the United States (Razavian,2001). In fact, all these multi-variate models are regionalization rather than actual climate identification models. The main characteristic of a model is its predictive power. None of the multi-variate regionalization are able to predict the climate of an unknown station. With the use of new data, changes to the previous schemes and repeated classification are required. Therefore, we use the term climatic model to develop an algorithm, based on existing data through which we can determine the climate of an unknown station. Several statistical studies utilizing clustering techniques have been conducted in Iran. Alijani (1993) explained the clustering method in the classification of Azarbijan thermal regions. Haidary and Alijani (1999) used 58 variables to classify the climate of Iran through the use of Principal Component and Cluster analyses. None of these multi-variate works are climate modelling, but regionalization. Any updating of the data through time requires the reclassification of the stations. On the other hand, although the works of Koeppen and others are criticized for their limited variables, adequate multi-variate substitutes have not yet been developed (Badr, 2000).

### 2. Data and methods

In order to develop a model of the climate of Iran, mean monthly values of 15 meteorological variables (169 monthly components in total) of 117 synoptic stations of Iran were obtained in the quality controlled format from the website of the Iranian Meteorological Organization (Bear, 1999).

The final models should be defined in a way that each could depict the characteristics of a specific climate type. In order to achieve this basic knowledge the country was classified into different climatic regions. These regions acted as the basis for the development of the models. Within the GIS environment, through the use of geostatistics, a specific model was defined for each region (climate type). The general procedure was as follows:

1. In order to achieve the climatic totality 169 monthly climatic components were selected.

However, since most of these variables and/or components were correlated, in order to reduce them to a few orthogonal factors, factor analysis with Varimax rotation was carried out.

This created the orthogonal factors or indices needed for regionalization.

2. Through the implementation of the cluster analysis, the 117 stations were clustered according to factor scores and distinctive regions were determined. In each region the lowest and highest thresholds of each factor score were identified. As mentioned earlier, these regions were the basis for the derivation of the final climatic models. These regions were based on the point data of 117 stations. Therefore, there were no data for the vast areas between the stations.

3. A layer with the point format was developed in the ArcGIS environment according to the geographical coordinates of the stations. Although the projections in Iran are mostly in the UTM system, since Iran covers four UTM zones, to minimize the interpolation errors the created geographic layer was transferred to the Lambert projection. Then, the factor score data were tabulated in this layer.

4. The tabulated factor scores of the station points were interpolated to the whole country through the implementation of the squared inverse distance weight (IDW) interpolation procedure. This procedure showed the least Root Mean Square Error (RMSE). Therefore, a digital map layer for the whole country was produced in which each cell of 5000 by 5000 meters possessed a digital value in each factor. This is the most important contribution of ArcGIS to climatic modeling.

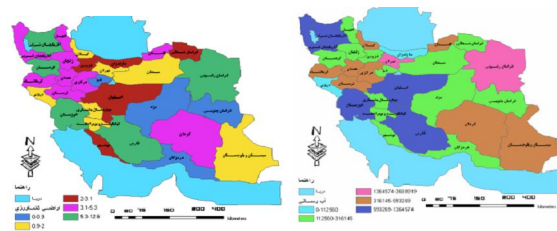
5. To solve the problem of the factors and develop a simpler model, a variable was selected for each factor according to the following criteria:

- having the highest loading with the factor,
- being one of the most common meteorological elements,
- the regions or polygons resulted from the selected variable coincide completely with the regions developed from the functions of the factor scores.

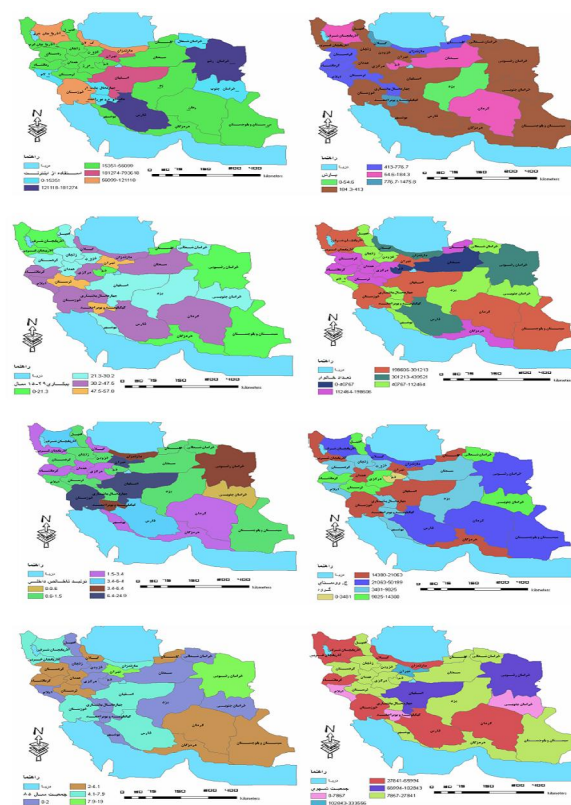
This process was achieved after several iterations and is the main criteria in selecting the indices. The

important rationale behind this step is to simplify the factors and choose a very simple variable to facilitate the use of the final model (Habibi, and Purahmand, 2001).

6. The final models of the regions were produced using discriminate analysis. In this way, each region has a unique model. These models are used to allocate any individual station in the suitable climate group. To this end, the coefficient of the station is computed in each of the models and the station is allocated to the model with the highest coefficient



**Fig. 1.** Location map of Iran and the used weather stations



**Fig 2:** The raster layers of the factors

### 3. Results

The implementation of PCA (Principal Component Analysis) with the Varimax rotation to

the 169 monthly climatic components of 117 stations resulted in six orthogonal components (Table 1).

**Table 1:** The explained variance of the components

Components	Eigenvalue	Variance in %	Cumulative variance	Factor scores
Temperature	55.705	31.831	31.831	-1.76 to 1.91
Humidity	30.137	17.221	49.053	-1.73 to 2.13
Mean wind speed	18.904	10.802	59.855	-2.7 to 1.92
Warm period rain	14.797	8.455	68.310	-1.39 to 5.34
Cold period rain	14.453	8.259	76.569	-1.46 to 5.7
Prevailing wind speed	11.573	6.613	83.182	-2 to 3.26

The extracted components explained about 83% of the total variance. Only those factors were selected that explained at least 5% of the total variance. These components are as follows:

**Temperature:** All of the heat measures are included in this factor. This factor explained 31.8% of the total variance. Its scores were low over the mountains and high in the central deserts.

**Humidity:** This component explained about 17% of the total variance and includes relative humidity indicating the moisture content of the atmosphere. It shows higher scores over the coastal areas of the south and north and negative values in the interior deserts (Adam, 2006).

**Wind speed:** This factor includes mean annual wind speed and explained 10.8% of the total variance. Its intensity is higher in the central parts of the country and decreases towards the national boundaries.

**Warm season rains:** Total rains of summer and autumn accounted for 8.4% of the total variance.

This factor is very important over the Caspian coastal areas (Modiri, 1999).

**Cold season rains:** The spatial importance of the cold season rains is less than that of the warm season, because these rains are distributed across the country. This factor is highlighted over the Zagros Mountains and accounts for 7.3% of the total variance.

#### 4. Climate regions

Hierarchical Clustering with the ward linkage method was used to classify the station point values into seven climate types.

The lowest and highest values of the factor scores within each type are shown in Table 2.

**Table 2:** Threshold values of the factors in each region

Regions	Temperature	Humidity	Mean wind speed	Warm period rain	Cold period rain	Prevailing wind velocity
First	-1.762, -0.308	-0.772, 1.685	-1.564, 1.706	-0.85, 0.127	-1.466, 1.057	-2.011, 1.048
Second	-1.672, -0.114	-0.754, 1.745	-1.496, 1.463	-0.763, 0.619	-1.414, 1.826	-0.25, 3.273
Third	-1.442, 0.453	-1.087, 0.109	-1.685, 1.316	-1.395, 0.182	0.352, 5.76	-1.339, 0.141
Fourth	-0.676, 1.335	-1.734, -0.176	-0.194, 1.858	-0.299, 1.308	-1.078, 0.122	-1.34, 1.58
Fifth	-0.344, 1.913	-1.406, 1.08	-2.7, 0.145	-1.38, 0.881	-1.254, 1.362	-0.957, 2.509
Sixth	1.308, 1.796	1.013, 2.131	-0.289, 2.221	-1.305, 0.486	-0.659, 0.708	-0.656, 1.694
Seventh	0.09, 0.633	0.866, 1.903	-1.499, 1.676	1.073, 5.351	-0.1, 2.176	-1.341, 0.242

These values are used as the thresholds for determining the climatic model of each type or region. By using the conditional functions of the ArcGIS environment and according to these threshold values, a function was defined for each region. For example the function, i.e., the model of the first region (the mountain region) is as follows:

$\text{Con}[(-1.762 < \text{fac.1} < -0.114) + (-0.772 < \text{fac.2} < 1.745) + (-1.564 < \text{fac.3} < 1.706) + (-0.85 < \text{fac.4} < 0.619) + (-1.466 < \text{fac.5} < 1.826) + (-2.011 < \text{fac.6} < 3.273)]$ .

In this function “Con” represents conditional function, and “fac.” represents factor. The lower and upper thresholds are taken from Table 2.

In contrast to the classic statistical methods, instead of sparse point data the pixel values of the rastered factor scores with very high resolution were used in these functions.

Application of these functions defined each cell of the raster layers of the factors in its corresponding region or type. Accordingly, several scattered or neighboring polygons were produced for each region. The first and second regions showed more than 95% overlap and hence were combined into one region. Finally, the polygons of all six regions were merged into one layer, producing the climate regions of the country. Due to the very fine spatial resolution of 5 km, the software was able to draw the regional boundaries very precisely. This ability of GIS has solved the long-lasting problem of precise boundary identification. The white areas on this map indicate the discrepancies occurring through merging, which are very small. In contrast to the classic statistical methods, instead of sparse point data the pixel values of the rastered factor scores with very high resolution were used in these functions. Application of these functions defined each cell of the raster layers of the factors in its corresponding region or type (Naghbi, 2006). Accordingly, several scattered or neighboring polygons were produced for each region. The first and second regions showed more than 95% overlap and hence were combined into one region. Finally, the polygons of all six regions were merged into one layer, producing the climate regions of the country. Due to the very fine spatial resolution of 5 km, the software was able to draw the regional boundaries very precisely. This ability of GIS has solved the long-lasting problem of precise boundary identification (Rahnarnaii, 1990). The white areas on this map indicate the discrepancies occurring through merging, which are very small and negligible. The factorial functions of all regions are listed below:



**Mountain (M)**

Con[(-1.762 < fac.1 < -0.114) + (-0.772 < fac.2 < 1.745) + (-1.564 < fac.3 < 1.706) + (-0.85 < fac.4 < 0.619) + (-1.466 < fac.5 < 1.826) + (-2.011 < fac.6 < 3.273)]

**Semi Mountain (SM)**

Con[1.442 < fac.1 < 0.453) + (-1.087 < fac.2 < 0.109) + (-1.685 < fac.3 < 1.316) + (-1.395 < fac.4 < -0.182) + (0.352 < fac.5 < 5.76) + (-1.339 < fac.6 < 0.141)]

**Desert (D)**

Con[(-0.676 < fac.1 < 1.335) + (-1.734 < fac.2 < -0.176) + (-0.194 < fac.3 < 1.858) + (-0.299 < fac.4 < 1.308) + (-1.078 < fac.5 < 0.122) + (-1.34 < fac.6 < 1.58)]

**Semi Desert (SD)**

Con[(-0.344 < fac.1 < 1.913) + (-1.401 < fac.2 < 1.08) + (-2.7 < fac.3 < 0.145) + (-1.38 < fac.4 < 0.881) + (-1.254 < fac.5 < 1.362) + (-0.957 < fac.6 < 2.509)]

**Coastal Desert (CD)**

Con[(1.308 < fac.1 < 1.796) + (1.013 < fac.2 < 2.131) + (-0.289 < fac.3 < 2.221) + (-1.305 < fac.4 < -0.486) + (-0.659 < fac.5 < 0.708) + (-0.656 < fac.6 < 1.694)]

**Coastal Wet (CW)**

Con[(0.09 < fac.1 < 0.633) + (0.866 < fac.2 < 1.903) + (-1.499 < fac.3 < 1.676) + (1.073 < fac.4 < 5.351) + (-0.1 < fac.5 < 2.176) + (-1.341 < fac.6 < 0.242)]

**Climate indices**

The models defined according to the factors have a main limitation. Each factor is composed of several variables whose share in the factor is difficult to determine. On the other hand, implementing all these variables means that the model does not summarize any information which is in contrast to the nature of modeling process. In fact, a classification scheme is as good as it is simple. For this reason we tried to select from each factor a representative variable (Rasuli, 2004). This variable is called an index. The representative index variable for each factor was selected according to the procedure outlined in the methodology section. The final six selected indices are as follows:

- 1 Mean annual minimum air temperature (T<sub>m</sub>) for the first factor.
- 2 Mean annual minimum relative humidity (RH<sub>m</sub>) for the second factor.
- 3 Mean annual wind speed in knots WS<sub>mean</sub> for the third factor.
- 4 Mean greatest daily precipitation of June to November period (GDP<sub>s</sub>) for factor four.
- 5 Mean monthly precipitation of January to April period (P<sub>c</sub>) for factor five.
- 6 Mean speed (in knots) of annual prevailing wind (PWS) for factor six.

These indices were placed in the model of the respective factor. The polygons produced by these indices corresponded to the ones of the factors. Several different variables were used to generate the

corresponding polygons. This repeated work was conducted in the GIS environment. Selecting both the indices and their thresholds was the most difficult and sensitive part of the research. The main criteria as mentioned earlier was the correspondence of the new classes with the primary regions (those created from the factors). This is achieved through several computerized iterations. On the final map each cell has a values for the indices. The thresholds of the indices for each region are presented in Table 3. According to these new thresholds the general form of the functions of the climate classes is written as:

Con[(L < T<sub>m</sub> < U) + (L < RH<sub>m</sub> < U) + (L < WS<sub>mean</sub> < U) + (L < GDP<sub>s</sub> < U) + (L < P<sub>c</sub> < U) + (L < PWS < U)]

In this formula L and U represents the lower and upper thresholds, respectively.

**Table 3:** The thresholds of the indices of the regional models

Regions	T <sub>m</sub>	RH <sub>m</sub>	WS <sub>mean</sub>	GDP <sub>s</sub>	P <sub>c</sub>	PWS
Mountain	0.9–11.3	23.08–58.5	2.3–7.5	10.17–66	16.3–100	5.8–15.4
Semi Mountain	2.5–13	23–32.5	2.4–5.1	9.3–27	50–200	6.55–9
Desert	4.5–18.5	15.5–43.85	4–7.5	5–50	10.6–61	11–12.8
Semi Desert	5.6–21.5	18–53	1.1–6.7	4–70	14–100	5.8–14
Coastal Desert	18–23.5	35–58.5	4.8–7.5	14–30	16.5–40	8–12
Coastal Wet	11–13	52–67	1.8–5.1	66–212	65–120	5–10

The thresholds of Table 3 were replaced in this formula and the functions of each climate class were defined as follows.

**Mountain**

Con[(0.9 < T<sub>m</sub> < 11.3) + (23.08 < RH<sub>m</sub> < 58.5) + (2.3 < WS<sub>mean</sub> < 7.5) + (10.17 < GDP<sub>s</sub> < 66) + (16.3 < P<sub>c</sub> < 100) + (5.8 < PWS < 15.4)]

**Semi Mountain**

Con[(2.5 < T<sub>m</sub> < 13) + (23 < RH<sub>m</sub> < 32.5) + (2.4 < WS<sub>mean</sub> < 5.1) + (9.3 < GDP<sub>s</sub> < 27) + (50 < P<sub>c</sub> < 200) + (6.55 < PWS < 9)]

**Desert**

Con[(4.5 < T<sub>m</sub> < 18.5) + (15.5 < RH<sub>m</sub> < 43.85) + (4 < WS<sub>mean</sub> < 7.5) + (5 < GDP<sub>s</sub> < 50) + (10.6 < P<sub>c</sub> < 61) + (11 < PWS < 12.8)]

**Semi Desert**

Con[(5.6 < T<sub>m</sub> < 21.5) + (18 < RH<sub>m</sub> < 53) + (1.1 < WS<sub>mean</sub> < 6.7) + (4 < GDP<sub>s</sub> < 70) + (14 < P<sub>c</sub> < 100) + (5.8 < PWS < 14)]

**Coastal Desert**

Con[(18 < T<sub>m</sub> < 23.5) + (35 < RH<sub>m</sub> < 58.5) + (4.8 < WS<sub>mean</sub> < 7.5) + (14 < GDP<sub>s</sub> < 30) + (16.5 < P<sub>c</sub> < 40) + (8 < PWS < 12)]

**Coastal Wet**

Con[(11 < T<sub>m</sub> < 13) + (52 < RH<sub>m</sub> < 67) + (1.8 < WS<sub>mean</sub> < 5.1) + (66 < GDP<sub>s</sub> < 212) + (65 < P<sub>c</sub> < 120) + (5 < PWS < 10)]



## 5. Climate model

We have so far tried to establish basic climate regions upon which the algorithms of the climate model can be established. The six indices used to define the regions are the main parameters comprising the climate of Iran. Therefore, the model of the climate of Iran was based upon these parameters. We developed a model which could include any individual station into a correct climate region or type by using these indices. The selection of the climate type of a station is possible from its characteristics over the selected indices. This process was done using Discriminant Analysis of the SPSS software. This software can allocate an individual station into a predefined set of classes. This methodology produced some classification coefficients by which the models were developed for each type based upon the indices employed. Then the scores of the models are summed separately. The individual station was allocated to a type whose sum was higher than the others. The coefficients and constants of the regions or in our words climate types are shown in Table 4.

**Table 4:** Coefficients and constants of the climate models

Indices	M	SM	D	SD	CD	CW
$T_m$	1.496	2.233	1.901	2.991	4.248	2.927
$RH_m$	1.866	1.744	1.220	1.568	2.929	2.905
$WS_{mean}$	-0.801	-1.548	0.492	-2.128	-0.025	-3.030
$GDP_s$	-0.227	-0.282	-0.182	-0.229	-0.408	0.047
$P_c$	0.174	0.351	0.133	0.190	0.246	0.233
$PWS$	2.327	2.054	1.975	2.834	1.821	2.027
Constant	-50.597	-59.223	-56.509	-56.230	-134.726	-131.991

By substituting these coefficients into the equations of the climate types the final climate models were defined as follows:

### Mountain

$$M = -50.6 + 1.496T_m + 1.866RH_m - 0.801WS_{mean} - 0.23GDP_s + 0.174P_c + 2.327PWS$$

### Semi Mountain

$$SM = -59.22 + 2.23T_m + 1.74RH_m - 1.55WS_{mean} - 0.282GDP_s + 0.351P_c + 2.054PWS$$

### Desert

$$D = -39.5 + 1.9T_m + 1.22RH_m + 0.492WS_{mean} - 0.182GDP_s + 0.133P_c + 1.97PWS$$

### Semi Desert

$$SD = -56.23 - 3T_m + 1.57RH_m - 2.13WS_{mean} - 0.23GDP_s + 0.19P_c + 2.83PWS$$

### Coastal Desert

$$CD = -134.72 + 4.25T_m + 2.93RH_m - 0.025WS_{mean} - 0.41GDP_s + 0.25P_c + 1.82PWS$$

### Coastal Wet

$$CW = -131.99 + 2.93T_m + 2.9RH_m - 3.03WS_{mean} + 0.05GDP_s + 0.233P_c + 2.3PWS$$

As a working example, the climate of Yazd is determined here. The values of the indices for Yazd are listed in Table 5.

**Table 5:** The climatic values of Yazd in the climatic indices

Indices	Yazd
$T_m$	11.4
$RH_m$	20.67
$WS_{mean}$	4.92
$GDP_s$	9.42
$P_c$	10.6
$PWS$	8.32
Constant	-131.991

## 6. Conclusions

Both the procedure followed in this study and the resulting climate classification models are unique.

The methodology utilized a combined package of classic statistics, geo statistics, and GIS. All these collaborated well in developing our final model. Using the classic statistics a base frame or knowledge of the climate of the country was developed, because this work was the first research in this field and a general picture of the climate was required. Without this basic picture a realistic model could not be developed. The resulting six climate types are reasonable and resemble the findings of previous work. At the second stage point values were interpolated across the country, which we believe is unique and has not been carried out in previous climate regionalization studies.

This methodology improved the spatial resolution of the model output. Due to the use of spatial autocorrelation functions with the radius of 5 km, we were able to generate very detailed spatial variations of the climate over the country. Accordingly, the regional boundaries were drawn with the higher degree of precision. This is very important in areas with diverse topography such as Iran.

The main advance of this study is the use of GIS to develop climate indices for a station, and the implementation of conditional functions and iteration processes of the ArcGIS environment to interpolate climate information over data sparse areas. The process of definition of these indices utilized classic regionalization and ArcGIS conditional functions within the ArcGIS environment. The climate classes are presented as a live map in the ArcGIS environment. Discriminant Analysis has provided great assistance in developing indices into a statistical model and defining their weights in the final models. It is also due to the potential of Discriminant Analysis that we could define the climate type of a station from only six climate types for the entire country. We tried to develop a model to define the

climate going beyond Koeppen and others. Although we ascribe shortcomings to their work, no climatic multi-element model to understand the totality of the climate had been developed. This study has achieved this task to some degree. It has demonstrated the usefulness of GIS in handling the spatial problems, and has stated that climatologists can improve their climate classifications using statistical and geo statistical methods provided by GIS.

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## Assessing Relationship between micro-credit and empowerment of rural women

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**Abstract:** rural woman helps to prepare farm , then she plows , harvests , does weeding and transplants , does milking and also acts as shepherd , weaves carpet , tries to make tools and handicrafts , bakes bread , cooks , does housekeeping duties , fetches water from water sources and from distances , fetches firewood , cares children , spins wool and makes curd , buttermilk , yogurt , butter and oil . In addition to all these, she is mother and family supervisor too. In spite of that rural women in developing countries are producer of about 80% of foods and responsible of supervising of about 30% of rural families, but their activities wasn't considered as economic activity and simply are removed from agriculture and rural development programs. Base on formal existing statistics, women form about 31% of agriculture active workforce in developing countries. While, informal and local statistics, estimate number of working women at agriculture part more than formal statistics. In Egypt, base on formal statistic, rural women's activity has been reported about 36 %. While local statistic represents between 35 to 50%. Base on formal statistic at many African countries (e.g. Congo) women's share at preparing labor workforce at agriculture part is 60% but base on informal statistics, above share is reported 80%. This statistical difference exists at most developing countries. In addition to aforementioned substances, it is possible to mention women's share of active force at agriculture part as follow.

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**Keywords:** empowerment, rural women, micro-credit

### Introduction:

Rural women constitute about half of the world's population and in the world production supply they have energetic communion and constitute a great part of agriculture workforce. They constitute% 50 of the workforce and they participate in the production of half of the foods in the agriculture section. As an example the rural women constitute about 70 to% 80 of agriculture workforce in sub-Saharan Africa, %65 in Asia, %45 in Latin American & Caribbean, %80 in Nigeria & Tunisia and %80 in India, but their role in production system is the men's supplements roles and this causes a big responsibility inside their mother & wife duties and it takes a great time and energy of them. Studies in this field show that women spend about two thirds of their time for production, management & organize of their house as the men spend only one third of their time for such things. (Varzegar & Azizi 1367).

In the development countries, rural societies which are poverty for geographic reasons such as being far from urban societies or because of mountainous of zone and also as the roads are impassable and some other reason, they became deprived of many human

development programs. Unfortunately these societies are suffering of mortality because of poverty but what is clear here is that we can't attribute such privation to geography and nature of the zone. Every country is trying to solve such critical conditions by applying depoverity policies. (Bakhshoodeh and Salami, 2005)

Poverty spreading in village is a global issue. According to the Fao finding about % 75 of world's poor people that are more than 1 milliard people are living in rural zone and more than % 70 of this poverty people are women. As the most of the people who are poor are living in village and are women is the reason for insufficiency of rural development programs.

One of the other basic barriers in development of rural women is their independent inaccessibility to get credits for investment in their job. Although their illiteracy is the big barrier to use of bank credits, but this view that women are dependent people that their husband should decide about their financial decisions is the other reason that rural women couldn't access to official credits. Maybe these barriers are the reason why rural women are happy about applying micro-credit thought in village. (Najafi, 2007).

**Economic effects of rural women's financial self-reliance:**

it is possible that rural women's financial self-reliance made some crudities ( malformations) in the family for a short time, for example, rural women became proud after financial independency and find the independence & Excellency sense in themselves but such problems will be small and for a short time.

The rural women's self-reliance has positive effects which is useful for women and their family and also will help their economic improvement that we will mention some of them. (Chowdhury, 2005).

### **3-1- Self-reliance and financial independency:**

The income of the rural women makes them financially independent. The financial independency will let them to spend their wage in the ways that they like. Of course their dependency to their family won't let them to spend their wage out of their family needs. Because of this, their financial independency will let them and their family to be self-reliance. (Ghaffari, 2000).

### **3-2- Change economic behavior:**

Although we are familiar with the rural women's role in the village and family's economic, but they direct & indirectly start a new economic relation, with finding modern jobs & financial independency. Catching loan from financial organizations has forced them to have economic schematization for loan reimbursement and to have intellectual economic behaviors. So after that rural women become active in economic activities. In rural traditional economic, women only have productive role and they don't have any role in economic planning, providence and they don't pay any attention to profits and losses. But in this new condition, for managing affairs in best way, the women have to be active in all of the affairs from production to dispense and also in others economic aspects. In other words, women will not be a productive only; they will contribute in managing of economic activities and will find various economic behaviors. . (Araghzadeh, 2002).

### **3-3- Independency:**

The rural women will not dependent economically to their father or husband because of financial independency, this independency is very important to women who have children or they have lost their husband, because the financial problems have forced the rural women to have marriage which is not suitable for their children & themselves. Although the women can solve their financial problems with this kind of marriage but they will have many cultural, social & mental problems. If these women could manage their life with having a job, they can improve their family & kinship's relation.

The rural men & women should notice that their financial independency is not the meaning of an independency in their family, social & cultural affairs and making consensus between financial & economic

affairs is necessary for family's consistency. (Fiona Steele et al, 2008).

### **3-4- Help to economic growth**

The rural women's financial self-reliance will increase their motivation for finding a good job. As a result our rural & urban society will develop by working of women. And it will help direct & indirectly to our society's economic development. As the women constitute about half of the rural & urban's population, so by increasing their production, our society will develop economically. (Jameela, 2010).

### **Importance of women's participation:**

It's not possible to reach rural development goals without understanding the present situation of society and its groups. Meanwhile identifying the groups with critical roles in the rural area development program will be of importance. Women, as a rural group, due to numerous reasons have always received the least attention while their activities in non-monetary sector play a certain role in rural household economy. As most men leave the village to work in town, women provide much of the agriculture force in the area. In recent years the situation has been more considerable as rural migration to town is getting more. In most Iranian villages women's population is more than men. According to FAO's reports, in some African regions, for 60% of families, women are responsible for supervising family. Even for cases that men are the direct responsible of production affairs, women's role in family economy can't be denied just because they don't get paid. Although these efforts appear to register in none of official statistics, they easily replace some other activities with significant financial value.

Studies by FAO show that more than half of the world's crops are collected by women. According to estimates, 1.3 billion of world's poor are women, thus the slogan "poverty has a feminine face" is spread worldwide.

Given that in many parts of the world, the production potential of women is not used properly, a cost-benefit study by the World Bank shows that investing on women in developing countries will be more profitable than any other investment. In addition to financial benefits of this huge force, its ancillary results will also be useful. The ancillary benefits of women's employment include: lower population growth and children mortality rates (Navab Akbar, 1997). Rural women are a big part of productive force and in developing countries third to half of them are supervising households; as a result they face numerous problems, such as:

- Lack of access to social and health facilities
- Various daily chores inside and outside the home
- Men's skill and increase of women's responsibility
- Lack of professional to educate women

Around the world and in Iran, the issue related to female employment, especially in rural areas (which is

a manifestation of participation), is not unemployment but unpaid employment; because all the unpaid work done by women at home, such as cleaning, washing, nursing, social affairs, agriculture and livestock,... are encountered as non-economical activities; While visible economic sector cannot continue to exist without this invisible sector's goods and services. On the other hand, rise of industrial system and expansion of factory job all over the world, attracted men to these economic systems and this has given men an objective vision; Whereas, the majority of women, due to working alone at home have got a subjective vision. Now, as women enter labor market and start to participate, they'll become objectified; because the work system will encourage them to think like men. Being more around the house and their local area will help both men and women in terms of subjectivity and objectivity (Arab-Mazar and Jamshidi, 2005).

Thus the issue of women's participation has important effects, including:

- Acceleration of plans implementation
- Realization of people's every day needs with cooperation and consultation
- Increasing efficiency and reducing functional expenses of projects
- Creating opportunities for talent realization and scientific activities
- Creating sense of solidarity and cooperation
- Increase social and personal awareness
- Women, sharing ideas in decision-making and determining their own destiny
- Participation of women as an important factor and a major power to achieve development

Therefore, according to preceding discussions and importance of women's participation in future plans, it's of great importance to study and recognize the factors affecting their participation in social activities of rural area (Fakhraee, 2002).

#### **Micro-credits:**

One of the raised strategy , in order to accelerate investment process and reinforcing financial foundations , and saving , at deprived and rural areas , has been empowering and eradicating poverty of rural societies through efficiency with emphasize on applying micro-credits (Shahnaj and Sajedur, 2009).

Micro-loans as useful tool to fight against poverty and starvation, has proven its capabilities and values to develop these areas. These tools have ability to change and improve human's life, especially poor peoples. Micro loans , saving accounts , and giving various bank services , cause this belief in low income and poor family that , by accessing to these services , their income will increase ,so they can protect themselves against barriers of unexpected problems and their current level of life and also invest on nutrition ,

housing and their children's education.( Varzgar and azizi, 2001)

Accessing to these conditions is among main goals of third millennium program (i.e. eradicating absolute poverty of human societies).

Nowadays micro-credits and supplying micro financial resources, has changed human's life and cause to revive different societies at poorest and richest countries of world, so that we can see growth in human's power to access to common financial services. By accessing to wide range of financial tools, families according to their priorities, invest on cases such as costs of education, healthcare, healthy and good nutrition or housing.

Applicants for Microfinance resources mostly involved family supervisor women, pensioners, homeless people, frugal workers, small farmers and micro entrepreneurs. These people are divided into four groups: Poor, very poor, relatively poor and vulnerable poor.

Whenever repayment afford , bond terms and accessing to data , in this classification will change , in order to supply sustainable financial needs of various clients , procedures and operation structures will be develop .( Fami, 2001)

Generally, in most countries, micro finance sources are considered for poor women. By women's access possibility to finance services, they committed to loan and ensure its repayment and preserve their saving accounts and also enjoy insurance cover. Supplying programs for micro financial resources have strong message for families and societies. Most of qualitative and quantitative studies and researches have proven that accessing to financial services; will improve women's conditions in family and society. Women's confidence has increased and they are aware of their abilities. (Banihashem, 1999)

Thus, it has proven that supplying financial services for poor peoples is powerful tool to decrease poverty so that make them able to establish finance, increase income and decrease vulnerability against economic pressures.

In micro-credits programs other than offering and distributing micro loans, there are also small savings and deposits so that they are designed as form of saving-credit programs. The existing term in phrase "micro-credits" points to two basic concepts that is due to dominant perspective on this approach. First term (i.e. credits) points to rural areas and lack of access for many villagers to formal resources that are one of their major problems. And at system of micro-credits, are tried to decrease poor families' access barriers to credit sources and also to increase effectiveness of these markets. Second term (i.e. micro) emphasize on deficiency of development, according to classic economist's method.



Emphasizing on concept of “micro” means revising recommendations of market economy at rural society's development.

Generally, goals of micro-credits programs are: (Moazami 2005)

- a- increasing access coefficient of low income rural women to credit facilities
- b- considering and focus on low income rural women groups
- c- empowering rural women to enjoy needed job skills
- d- empowering rural women to deal with group works and cooperative activity
- e- equipping non-productive villager's saving (women) to effective and productive investment
- f- planning in order to perform projects that are based on capacities and facilities of that area
- g- breaking poverty cycle and saving rural family
- h- Developing employment and stabilizing jobs which faced financial crisis

#### **Micro-credit characteristics:**

##### **1- Empowerment**

Empowerment is one of the major goals of micro-credit and it's considered as a proper index to evaluate it. Creating self-reliance and self-confidence in people, empowerment is one of the important factors to deal with poverty. It also creates social capacity.

Empowerment plans include:

- 1. Forming financial groups and creating social capacity
- 2. Education as a supplementary factor of credit-saving
- 3. Assigning management of credit plans to members

##### **2- Stability**

Stability is a fundamental characteristic for a comprehensive development program and leads to continuance of the program and makes credit-saving plans different from others.

Stability indicators:

- reduce dependence on external financial resources
- reduce trading expenses
- cut the loan subsidies (Banihashem, 1999)

##### **3- creating and expanding income generating activities**

A study conducted by World Bank about micro financial institutions highlights three most frequent goals:

- 1. Creating employment opportunities for members
- 2. Increasing vulnerable groups' income and productivities
- 3. Reduce family's dependence on agriculture in droughts' prone areas

Rural women are among those major groups at society who previously were considered less by planners, due to specific reasons in the past. And this problem is more observable at developing countries. While, by looking at women's history of economic and social life, we can find that this great group, continuously have played basic role in forming economic condition of country. This great group consistent with men have had active role at areas of social-economic activities and always have had major part on economic production of society. Nowadays, supporting family supervisor women is adopted by universal society, as politic, economic a social concern and nearly all countries applied related approaches, and however these efforts have resulted in failure, in so many cases (Banihashem, 1999). paying part of cost of life by government or charities , establishing forums to analyze family supervisor women's problems , supplying necessary facilities to grow and improve child's life quality and paying facilities to provide sustainable employment , are among most important approaches to support family supervisor women . Paying credit facilities to access sustainable employment with easy terms at limited time, is one of the most important approaches to support family supervisor women. Because alongside supplying their continues needs, their esteem wouldn't be marred. Currently, this approach is used at many countries and positive results have emerged. (Ghaffari, 2000).

#### **Empowering rural women:**

Empowerment is capacity that woman can obtain in cultural and social environment, for economic independency and self reliance, by controlling over emotional decision making and far from violation. Empowering means, evolution and developing activities through non governmental organizations (NGOS) that lead empowerment to improve economic dimensions. (Amiri, 2000)

Enabling is process that, during it, people of society do activities to overcome barriers of advancement that finally cause their domination to determine their own density. The term “enabling” means overcoming fundamental inequalities. So it is different from self-reliance. (UNICEF, 1997)

Enabling, enables individual to overcome any problematic condition and consider barriers and problems as part of life and positive campaign. Finally, enabling provides energy to overcome most intellectual barriers and external problems at private life.

Thus, among all what have been said, it is possible to present suitable definition of enabling women, as follows:

“Process of explaining women about themselves (and also men about them) for instances that they must or want to do, and growth of their willingness and courage until they reach to needed competency “(management of rural and tribal women).

it should be noted here , that major factor which should be considered about women’s ability , is eliminating individual and social barriers , and finally preparing field of economic and social participation for women at all fields . purpose of women’s participation , is because of their dominance on all affairs of village including decision making process , organizations , forums , enterprising posts and ... that involve , participation at all social and economic dimensions .

#### **Discussion and conclusion:**

Woroniuk و Schalkwyk (1998) at their conducted research believe that now, micro credits, micro finance sources and small business unites are most effective mechanism to decrease poverty.

Plitt and others, conducted research as they called it “do credits programs, can empower women “? Results showed that corporation at credits programs helps empowering women.

Goetz و Sengupta (2003), presented negative image of credits effects on empowering women. They concluded that most women have minimum control on their loans. And when repayment period is short, this shortage of control has devastating effects on women welfare.

Hashemi and others (2004) found that joining to Gramin Bank, has meaningful positive affects on controlling women, and helps to family income.

In researches that conducted by Nanda (2004) became clear that women participation in credits programs had positive affects on their demand about health care.

Fiona Steele and etal (2008) in researches that conducted as called “ influences of credits programs on empowering women at Bangladesh , found that women who joined to credits programs , have participated in more educational programs and have married with more educated men and also they have saved more and they had more cash .

Ellen and her colleagues (2009) used approach called it “credits and education at Bolivia, Ghana,

Honduras, Mali and Thailand”. This approach looks for empowering women through financial services with education. In this approach, women get familiar with importance of credits through education and extension and also familiar with ways to access it through establishing different groups.

Shahnaj and chaudhury(2009) in research as “credits and its role on empowering women “ concluded that there is meaningful relation between attending in credits programs and empowering women , at economical dimensions .

Ruhal amin and others (2010) found that those who joined credit funds had more ability rather than those who didn’t.

Jameela (2010) presented that credit programs has shown lot of affects on empowering women so that has increased their social, politic and economic ability.

Thus it is obvious that credits programs and its educational and empowering programs can be affective on social, humane and economic development or rural society, if it be associated with proper and gradual practices and base on reciprocal communications principles and apply opinion of local society.

Maybe the main challenges that threaten credits associations , is lack of necessary emphasizes on social dimensions and on reinforcing their basics , that practically cause that this social foundations lose its efficiency soon and practically changed to unsuccessful institution .

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## Different aspects of empowerment of rural women in developing countries

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**Abstract:** One of the raised strategy , in order to accelerate investment process and reinforcing financial foundations , and saving , at deprived and rural areas , has been empowering and eradicating poverty of rural societies through efficiency with emphasize on applying micro-credits .Micro-loans as useful tool to fight against poverty and starvation, has proven its capabilities and values to develop these areas. These tools have ability to change and improve human's life, especially poor peoples. Micro loans , saving accounts , and giving various bank services , cause this belief in low income and poor family that , by accessing to these services , their income will increase ,so they can protect themselves against barriers of unexpected problems and their current level of life and also invest on nutrition , housing and their children's education.

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**Keywords:** empowerment, rural women, developing countries

### Introduction:

Having investment (capital) independency enforce people to think about economic from different angles. He should study the ways for using capital, he must consult with authority and experienced people and he will investigate about relevant markets. Such things will help him to be authoritative & independent. But how rural women can get such independency? Are the women created inherently for housekeeping, parenting and working or is there any opportunity for rural women to show their skills in economic & social development?

It seems that experiences which are obtained from performing financial programs in some villages in the developing countries could answer clearly to such questions.

A glimpse to previous planning about rural development in the world shows that from 1950 many developing countries understood that the main reason for making their economic growth (development) slowly in their countries is the weakness of investment in the agriculture part. Although many countries by patterning from developed societies have proceeded to improve & develop their industrial agriculture part and by this action not only had irreparable damages to many traditional farmers but also the main problem (the lack of capital sources) is also remained in the rural regions. (Rahimi, 2001).

From 1970, the waves of thought about micro-credits and run of small activity in villages was one

of the suitable way get increased for invest improvement in rural occupations.

The said plan because of special grants such as giving loan with low wage and no interest and with long reimbursement could give farmers this opportunity to don't rely usurers and jobber intermediaries. Indeed giving micro-credits to rural women was more effective. Because along agriculture activities which need more investments, the women with using micro-credits couldn't only show their talent in rural production, but also could improve their economic & social empowerments and they could also participate in social activities. (Chabokru et al, 2005).

Women's self-reliance and independency were the outcome of giving credits to women and in some cases were the obstacle of receiving credits by women which is necessary to explain about them shortly

### Importance of women's participation:

It's not possible to reach rural development goals without understanding the present situation of society and its groups. Meanwhile identifying the groups with critical roles in the rural area development program will be of importance. Women, as a rural group, due to numerous reasons have always received the least attention while their activities in non-monetary sector play a certain role in rural household economy. As most men leave the village to work in town, women provide much of the agriculture force in the area. In recent years the situation has been more considerable as rural migration to town is getting more. In most Iranian villages women's population is more than men. According to FAO's reports, in some African regions, for 60% of

families, women are responsible for supervising family. Even for cases that men are the direct responsible of production affairs, women's role in family economy can't be denied just because they don't get paid. Although these efforts appear to register in none of official statistics, they easily replace some other activities with significant financial value.

Studies by FAO show that more than half of the world's crops are collected by women. According to estimates, 1.3 billion of world's poor are women, thus the slogan "poverty has a feminine face" is spread worldwide.

Given that in many parts of the world, the production potential of women is not used properly, a cost-benefit study by the World Bank shows that investing on women in developing countries will be more profitable than any other investment. In addition to financial benefits of this huge force, its ancillary results will also be useful. The ancillary benefits of women's employment include: lower population growth and children mortality rates (Navab Akbar, 1997).

Rural women are a big part of productive force and in developing countries third to half of them are supervising households; as a result they face numerous problems, such as:

- Lack of access to social and health facilities
- Various daily chores inside and outside the home
- Men's skill and increase of women's responsibility
- Lack of professional to educate women

Around the world and in Iran, the issue related to female employment, especially in rural areas (which is a manifestation of participation), is not unemployment but unpaid employment; because all the unpaid work done by women at home, such as cleaning, washing, nursing, social affairs, agriculture and livestock,... are encountered as non-economical activities; While visible economic sector cannot continue to exist without this invisible sector's goods and services. On the other hand, rise of industrial system and expansion of factory job all over the world, attracted men to these economic systems and this has given men an objective vision; Whereas, the majority of women, due to working alone at home have got a subjective vision. Now, as women enter labor market and start to participate, they'll become objectified; because the work system will encourage them to think like men. Being more around the house and their local area will help both men and women in terms of subjectivity and objectivity (Arab-Mazar and Jamshidi, 2005).

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- Acceleration of plans implementation
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-Women, sharing ideas in decision-making and determining their own destiny

-Participation of women as an important factor and a major power to achieve development

Therefore, according to preceding discussions and importance of women's participation in future plans, it's of great importance to study and recognize the factors affecting their participation in social activities of rural area (Fakhraee, 2002).

Rural women are among those major groups at society who previously were considered less by planners, due to specific reasons in the past. And this problem is more observable at developing countries. While, by looking at women's history of economic and social life, we can find that this great group, continuously have played basic role in forming economic condition of country. This great group consistent with men have had active role at areas of social-economic activities and always have had major part on economic production of society. Nowadays, supporting family supervisor women is adopted by universal society, as politic, economic a social concern and nearly all countries applied related approaches, and however these efforts have resulted in failure, in so many cases (Banihashem, 1999). paying part of cost of life by government or charities , establishing forums to analyze family supervisor women's problems , supplying necessary facilities to grow and improve child's life quality and paying facilities to provide sustainable employment , are among most important approaches to support family supervisor women . Paying credit facilities to access sustainable employment with easy terms at limited time, is one of the most important approaches to support family supervisor women. Because alongside supplying their continues needs, their esteem wouldn't be marred. Currently, this approach is used at many countries and positive results have emerged. (Ghaffari, 2000).

#### **Empowering rural women:**

Empowerment is capacity that woman can obtain in cultural and social environment, for economic independency and self reliance, by controlling over emotional decision making and far from violation. Empowering means, evolution and developing activities through non governmental organizations (NGOS) that lead empowerment to improve economic dimensions. (Amiri, 2000)

Enabling is process that, during it, people of society do activities to overcome barriers of advancement that finally cause their domination to determine their own density. The term "enabling" means overcoming fundamental inequalities. So it is different from self-reliance. (UNICEF, 1997)



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Thus, among all what have been said, it is possible to present suitable definition of enabling women, as follows:

“Process of explaining women about themselves (and also men about them) for instances that they must or want to do, and growth of their willingness and courage until they reach to needed competency “(management of rural and tribal women).

it should be noted here , that major factor which should be considered about women’s ability , is eliminating individual and social barriers , and finally preparing field of economic and social participation for women at all fields . purpose of women’s participation , is because of their dominance on all affairs of village including decision making process , organizations , forums , enterprising posts and ... that involve , participation at all social and economic dimensions .

#### **Criteria of empowering women:**

Enabling as a theory of policy making for women, in it present five criteria:

Welfare, access, Concientisation, participation and control.

##### **1- welfare criteria :**

In this criteria, men and women as human resources of development should enjoy of desirable welfare conditions and equality (Paknazar, 2000).

Most of timing developmental programs, have worked on base of women’s welfare. They have considered and provided some services for women who were passive recipient of these services. But these services were limited to physical needs and mostly were considered to revive their role of productivity, again. sometimes , it has been said that this approach has begun at colonial era and has considered women from poor country and intended services for them that dose not exceed from that poverty level . Agricultural and industrial projects were designed for men and social programs for women and children. Most of welfare programs were inadequate or its success was limited. Considerable point in this criteria is that men and women as human resources of development should enjoy equality and desirable welfare conditions. At this stage, women’s material welfare and their enjoyment of welfare programs, compared to men (nutrition, death rate and ...) were considered. And women’s role as producer to supply their own needs isn’t very important.

##### **2- access criteria :**

Lack of access or limited access for women to sources including (fields, job, capital and training) cause that their functions at production is less than men (Paknazar 2000). Access to facilities, sources, designed program and projects for women and access to schools and ... are in this part. Just whenever most of other legal, cultural and social issues being solved, men and women would equally access to sources and facilities. Concept of enabling at this stage is that women have equal right to access to sources at family and greater society.

##### **3- Concientisation criteria**

Women should know that their problems aren’t due to their individual inefficiency and shortage but it has emerged by social system in which discriminations has become formal and acceptable issue. (Araghzadeh, 2002). This stage is more critical and important than other stages. Because women can participate at development activities not just be passive users. Women have real equality at development, just when be aware. Concientisation will help to increase women’s ability to equality at participation at society. At this stage, women face with critical analysis with society and will find that what has been considered natural and unchangeable reality, is changeable. (Bakhshoodeh, 2005).

##### **4- Participation criteria**

One the most important items that this criteria has considered , is men and women’s equal participation at decision making process of affairs of family at society (Paknazar 2000 ) . Men and women both should participate at process of assessment needs, designing, performing and evaluation of projects and development programs (UNICEF, 1998). In summary, this criterion means women’s participation at all stages of surveying needs, detecting problems, planning, management, performing and valuation.

##### **5- Control criteria**

This criterion emphasize on this point that in addition to equal access of men and women to development sources , they must have adequate control on these sources that this issue is balance criterion , between men and women so that no one exceed other one (Paknazar 2000 ) . Women should have opportunities for decision making at workplace and home. If woman is producer, should be shared with part of her interest and wage. Women like men, should be able to choose her individual and social field and able to make decision and also development activities should be facilitator of these processes.

FAO (food and agricultural organization) addresses these three purposes as strategic goals while enabling women:

- 1- equality between men and women to access production sources

- 2- women's participation at policy and decision making
- 3- decreasing rural women's workload and increasing job opportunity and income for them (Paknazar 2000 )

within theoretical framework of enabling women , having control on sources is presented as highest stage at women's participation process on development , but existing data at most developing countries , indicates that not only rural women haven't any control on financial resources of family but even they were deprived to access to sources and credits , specially through formal credits system (Shaditalab, 2002 ) .

The question that arises here is that what relation is there between enabling women and micro-credits programs? Nowadays, micro-credits are considered as effective mechanism to eradicate poverty for women. Interests of micro-credits further increasing women's income, include:

- improving women's role in family
- Increasing women's confidence, not only through obtain financial success through business activity, but through increasing women's access to social services and communication with other women.
- Changing at social level (social class) at perspective of women's role.

#### **.Discussion and conclusion:**

If rural women could provide a job for them by getting credits, loan and other financial convenience, through their income they can get self-reliance or financial independency and we will see social, cultural & economic change in village. The question here is that if these changes have positive or negative aspects in the village? It's natural that every change in social phenomenon has both positive and negative aspect, but which is Important here is that which aspect is more than the other and it depends to different condition in various societies. In our rural society there is an especial social & cultural kind that it's outcome maybe different and in some case inconsistent. With these actions rural women could be in idealistic economic condition and they could live with out dependency to their husband's income. In most of the villages in Iran there is patriarchy in the families which is not acceptable for the most of the rural people and groups. When rural women became financially independent, it's acceptable to see its cultural & social outcomes.

Giving the right that women make decision, independency to their family, increasing the cultural knowledge among them& making relation with new institutions, having independency in making decision

about marriage, occupation, migration & something like this are the right that women have got it.

Women by getting these rights can make change in the rural cultural & social issues which make disfunction & crudity in their family's relation. However, rural women's self-reliance has caused improvement in the economic, social & cultural issues. For solving women's self-reliance problems we can do these activities:

- Giving promotional services for increasing rural women's skills in various fields.
- Giving promotional instructions to men for believing their women's economic role & their women opportunity to participate in all economic, authority & ... aspects.
- Increasing rural women's knowledge in all social, political, cultural & economic fields.
- Making use of micro-credits programs to motivate & support women for doing economic affairs better & finally to make women self-reliance.

Nowadays, micro-credit and micro-financing have changed people's lives; it has brought back life to poorest and richest communities of the world. So we can easily observe a great increase in people's access to general financial services. Facilitating the access of families to financial services, they begin to invest on educational expenses, healthcare, healthy nourishment, trading, and housing based on their priorities. Overall in many countries financial plans mostly focus on women. Women, provided with financial facilities, will receive a loan, guarantee to pay it back, keep their saving account and also they'll have insurance coverage. Micro-financial plans have an important message for families and communities. Many studies have proven that women's access to mentioned facilities may improve their conditions in family and society; it also helps them feel more self-confident and makes them aware of their own abilities. Thus providing micro-credit services for the poor in society is a powerful tool to reduce poverty and so that they are able to create assets, earn more money and become less vulnerable against the economic pressure. Of about 1.3 billion poor in the world there are 900 million poor women, this obviously shows that poverty has a feminine face. According to UN's development fund, 10% of world's income and less than 10% of world's assets belongs to women. While a majority of them never posses the capital needed for their activities, women still play an important role in the economic development of country. Therefore women draw the micro-credit policy maker's attention more than others. Choosing women as the

main target of micro-credit plans is an effective strategy to eradicate poverty; because their income will upgrade the family welfare; furthermore earning money improves their social status. In some countries this choice is influenced by society's attitude and culture (Araghzadeh, 2002).

For instance founder of Grumman Bank of Bangladesh, Mohammad Yunes, has stated that: "women have plans for themselves, their children, and their family life; they always have an overlook while men just look for fun" to explain why 94% of their clients are women.

Women's access to micro-credits have shown that their income benefit to improve their family and provide livelihood. In addition to all these another reason of women being the target of micro-credit plans is that women have higher loan recovery rates. Totally, expanding women's access to micro-credits may lead to many useful results which in economy is mentioned as "virtuous spiral"; because their access to micro-credits results in family welfare and in a broader point it'll improve community's welfare and shall be increased welfare this process is repeated.

In researches that conducted by Nanda (2004) became clear that women participation in credits programs had positive effects on their demand about health care. Fiona Steele and et al (2008) in researches that conducted as called " influences of credits programs on empowering women at Bangladesh , found that women who joined to credits programs , have participated in more educational programs and have married with more educated men and also they have saved more and they had more cash .

Shahnaj and Chaudhury(2009) in research as "credits and its role on empowering women " concluded that there is meaningful relation between attending in credits programs and empowering women , at economical dimensions .

Maybe the main challenges that threaten credits associations , is lack of necessary emphasizes on social dimensions and on reinforcing their basics , that practically cause that this social foundations lose its efficiency soon and practically changed to unsuccessful institution .

Fiona Steele and et al (2008) in researches that conducted as called " influences of credits programs on empowering women at Bangladesh , found that women who joined to credits programs , have participated in more educational programs and have married with more educated men and also they have saved more and they had more cash .

Ellen and her Colleagues (2009) used approach called it "credits and education at Bolivia, Ghana, Honduras, Mali and Thailand". This approach looks for empowering women through financial services with education. In this approach, women get familiar with importance of credits through education and extension

and also familiar with ways to access it through establishing different groups.

Ruhal Amin and others (2010) found that those who joined credit funds had more ability rather than those who didn't.

Jameela (2010) presented that credit programs has shown lot of affects on empowering women so that has increased their social, politic and economic ability.

Thus it is obvious that credits programs and its educational and empowering programs can be affective on social, humane and economic development or rural society, if it be associated with proper and gradual practices and base on reciprocal communications principles and apply opinion of local society.

A study conducted by Chabokru et al (1384) shows the crucial importance of micro-credits for farmers who do not possess physical financial assets (land, building, livestock, well...) and work in agricultural sector because of environmental conditions (such as living in a village) or because it's their ancestral occupation.

So today, women's participation in sustainable economic, social, and cultural development in rural areas is not optional but an essential matter. Those communities that have not seriously considered the necessity of participation faced failures and delayed community's development, welfare and security process. In any community, village, or social group, broad participation of every women in decision-making and any other matter related to national or local development programs, is a key variable in social sciences and in the last few decades, it has interested many scholars of socio-economic and especially cultural issues, and is considered as one of the most fundamental democratic rights of women in a society. As we know in a popular participation, all people are given the opportunity to participate in planning and decision making for their society and for their own future. When in practice women feel that they can be involved in planning, policy making and deciding or solving problems in the society certainly they'll feel more solidarity and become more interested in social, economic, and cultural development programs.

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**Empowerment of rural women: recommendations for developing countries**<sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh<sup>1,2</sup> Department of Agricultural Extension and Education, Varamin Branch, Islamic Azad University, Varamin, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** However rural women play major role to produce food at all over the world, but rarely enjoy of extension services. Wherever, rural women as producers of food productions and family supervisor, have little contact with extension services organizations, so their problems and needs would reflect at extensional information feedback, rarely. Therefore agricultural research institutions wouldn't be able to create and develop technology, suitable for their needs. Global surveys show that about 5% of total extension resources, at all over the world dedicated to programs for female farmers, but women form just 15% of extension personnel of world. Some extensional issues that traditionally belong to women, such as economy of family, are supported very little that receive just about 1% of total extension resources of agriculture.

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**Keywords:** empowerment, rural women, developing countries

**Introduction:**

Rural women constitute about half of the world's population and in the world production supply they have energetic communion and constitute a great part of agriculture workforce. They constitute% 50 of the workforce and they participate in the production of half of the foods in the agriculture section. As an example the rural women constitute about 70 to% 80 of agriculture workforce in sub-Saharan Africa, %65 in Asia, %45 in Latin American & Caribbean, %80 in Nigeria & Tunisia and %80 in India, but their role in production system is the men's supplements roles and this causes a big responsibility inside their mother & wife duties and it takes a great time and energy of them. Studies in this field show that women spend about two thirds of their time for production, management & organize of their house as the men spend only one third of their time for such things. (Varzegar & Azizi 1367).

In the development countries, rural societies which are poverty for geographic reasons such as being far from urban societies or because of mountainous of zone and also as the roads are impassable and some other reason, they became deprived of many human development programs. Unfortunately these societies are suffering of mortality because of poverty but what is clear here is that we can't attribute such privation to geography and nature of the zone. Every country is trying to solve such critical conditions by applying depoverity policies. (Bakhshoodeh and Salami, 2005)

Poverty spreading in village is a global issue. According to the Fao finding about % 75 of world's poor people that are more than 1 milliard people are living in rural zone and more than % 70 of this poverty people are women. As the most of the people

who are poor are living in village and are women is the reason for insufficiency of rural development programs.

One of the other basic barriers in development of rural women is their independent inaccessibility to get credits for investment in their job. Although their illiteracy is the big barrier to use of bank credits, but this view that women are dependent people that their husband should decide about their financial decisions is the other reason that rural women couldn't access to official credits. Maybe these barriers are the reason why rural women are happy about applying micro-credit thought in village. (Najafi, 2007).

Having investment (capital) independency enforce people to think about economic from different angles. He should study the ways for using capital, he must consult with authority and experienced people and he will investigate about relevant markets. Such things will help him to be authoritative & independent. But how rural women can get such independency? Are the women created inherently for housekeeping, parenting and working or is there any opportunity for rural women to show their skills in economic & social development?

It seems that experiences which are obtained from performing financial programs in some villages in the developing countries could answer clearly to such questions.

A glimpse to previous planning about rural development in the world shows that from 1950 many developing countries understood that the main reason for making their economic growth (development) slowly in their countries is the weakness of investment in the agriculture part. Although many countries by patterning from developed societies have proceeded to improve &



develop their industrial agriculture part and by this action not only had irreparable damages to many traditional farmers but also the main problem (the lack of capital sources) is also remained in the rural regions. (Rahimi, 2001).

### **Rural women empowerment:**

The empowerment is equality that women for financial self-reliance and self-sufficiency can obtain by controlling their emotional decisions. The empowerment can be defined as an evolution and development of activity through private organizations that guides empowerment in the society toward economic improvement.

Empowerment is a process through which people can do activities to conquest on development obstacles that enable them to assign their destiny.

The word empowerment is not the meaning of overcome to main in equalities so it is different with the word self-reliance. (Ruhailamin, 2010).

Empowerment enable person to overcome any difficulties by a suitable management. Finally we can say empowerment provide energy to conquest on mental problems & outer difficulties.

On conclusion we can give a suitable definition to women's empowerment as this: the process of realization of women about themselves (and also the men's realization about them) for the thing they want or have to do.

It should be reminded that the main point should be attended in women's ability is the omission of subjective & social problems and providing economic & social communion for women in all aspects. The mean of women communion is their presence in all of village affairs such as making decision, presence in organization & councils that includes their communion in all economic & social aspects. (Araghzadeh, 2002)

If rural women could provide a job for them by getting credits, loan and other financial convenience, through their income they can get self-reliance or financial independency and we will see social, cultural & economic change in village. The question here is that if these changes have positive or negative aspects in the village? It's natural that every change in social phenomenon has both positive and negative aspect, but which is Important here is that which aspect is more than the other and it depends to different condition in various societies. In our rural society there is an especial social & cultural kind that it's outcome maybe different and in some case inconsistent. With these actions rural women could be in idealistic economic condition and they could live with out dependency to their husband's income. In most of the villages in Iran there is patriarchy in

the families which is not acceptable for the most of the rural people and groups. When rural women became financially independent, it's acceptable to see its cultural & social outcomes.

Giving the right that women make decision, independency to their family, increasing the cultural knowledge among them& making relation with new institutions, having independency in making decision about marriage, occupation, migration & something like this are the right that women have got it.

Women by getting these rights can make change in the rural cultural & social issues which make disfunction & crudity in their family's relation. However, rural women's self-reliance has caused improvement in the economic, social & cultural issues. For solving women's self-reliance problems we can do these activities:

- Giving promotional services for increasing rural women's skills in various fields.
- Giving promotional instructions to men for believing their women's economic role & their women opportunity to participate in all economic, authority & ... aspects.
- Increasing rural women's knowledge in all social, political, cultural & economic fields.
- Making use of micro-credits programs to motivate & support women for doing economic affairs better & finally to make women self-reliance.

### **Criteria of empowering women:**

Enabling as a theory of policy making for women, in it present five criteria:

Welfare, access, Concientisation, participation and control.

#### **1- welfare criteria :**

In this criteria, men and women as human resources of development should enjoy of desirable welfare conditions and equality (Paknazar, 2000).

Most of timing developmental programs, have worked on base of women's welfare. They have considered and provided some services for women who were passive recipient of these services. But these services were limited to physical needs and mostly were considered to revive their role of productivity, again. sometimes , it has been said that this approach has begun at colonial era and has considered women from poor country and intended services for them that dose not exceed from that poverty level . Agricultural and industrial projects were designed for men and social programs for women and children. Most of welfare programs were inadequate or its success was limited. Considerable

point in this criteria is that men and women as human resources of development should enjoy equality and desirable welfare conditions. At this stage, women's material welfare and their enjoyment of welfare programs, compared to men (nutrition, death rate and ...) were considered. And women's role as producer to supply their own needs isn't very important.

## **2- access criteria :**

Lack of access or limited access for women to sources including (fields, job, capital and training) cause that their functions at production is less than men (Paknazar 2000). Access to facilities, sources, designed program and projects for women and access to schools and ... are in this part. Just whenever most of other legal, cultural and social issues being solved, men and women would equally access to sources and facilities. Concept of enabling at this stage is that women have equal right to access to sources at family and greater society.

## **3- Concientisation criteria**

Women should know that their problems aren't due to their individual inefficiency and shortage but it has emerged by social system in which discriminations has become formal and acceptable issue. (Araghzadeh, 2002). This stage is more critical and important than other stages. Because women can participate at development activities not just be passive users. Women have real equality at development, just when be aware. Concientisation will help to increase women's ability to equality at participation at society. At this stage, women face with critical analysis with society and will find that what has been considered natural and unchangeable reality, is changeable. (Bakhshoodeh, 2005).

## **4- Participation criteria**

One the most important items that this criteria has considered , is men and women's equal participation at decision making process of affairs of family at society (Paknazar 2000 ) . Men and women both should participate at process of assessment needs, designing, performing and evaluation of projects and development programs (UNICEF, 1998). In summary, this criterion means women's participation at all stages of surveying needs, detecting problems, planning, management, performing and valuation.

## **5- Control criteria**

This criterion emphasize on this point that in addition to equal access of men and women to development sources , they must have adequate control on these sources that this issue is balance criterion , between men and women so that no one exceed other one (Paknazar 2000 ) . Women should have opportunities for decision making at workplace and home. If woman is producer, should be shared with part of her interest and wage. Women like men, should be able to choose her individual and social field and able to

make decision and also development activities should be facilitator of these processes.

FAO (food and agricultural organization) addresses these three purposes as strategic goals while enabling women:

- 1- equality between men and women to access production sources
- 2- women's participation at policy and decision making
- 3- decreasing rural women's workload and increasing job opportunity and income for them (Paknazar 2000 )

within theoretical framework of enabling women , having control on sources is presented as highest stage at women's participation process on development , but existing data at most developing countries , indicates that not only rural women haven't any control on financial resources of family but even they were deprived to access to sources and credits , specially through formal credits system (Shaditalab, 2002 ) .

The question that arises here is that what relation is there between enabling women and micro-credits programs? Nowadays, micro-credits are considered as effective mechanism to eradicate poverty for women. Interests of micro-credits further increasing women's income, include:

- improving women's role in family
- Increasing women's confidence, not only through obtain financial success through business activity, but through increasing women's access to social services and communication with other women.
- Changing at social level (social class) at perspective of women's role.

## **Discussion and conclusion:**

Supplying credits and analyzing credits approaches cause opportunity to activate poor men's working In researches that conducted by Nanda (2004) became clear that women participation in credits programs had positive affects on their demand about health care.

Fiona Steele and etal (2008) in researches that conducted as called " influences of credits programs on empowering women at Bangladesh , found that women who joined to credits programs , have participated in more educational programs and have married with more educated men and also they have saved more and they had more cash .

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Thus it is obvious that credits programs and its educational and empowering programs can be effective on social, humane and economic development of rural society, if it be associated with proper and gradual practices and based on reciprocal communications principles and apply opinion of local society.

Maybe the main challenges that threaten credits associations, is lack of necessary emphasis on social dimensions and on reinforcing their basics, that practically cause that this social foundations lose its efficiency soon and practically changed to unsuccessful institution.

In order to overcome dominant consideration, experts believe that we should consider following in protection process of these social institutions.

- establishing and reinforcing through supporting without any direct government involvement
- evaluating and constant modifying of financial management mechanisms
- improving organization effectiveness
- establishing constant relation and interaction with similar and equal systems.
- establishing local, regional and national networks
- establishing support and cover systems in order to decrease risk
- establishing balance and interaction with financial systems greater decision making include: capital market (local, regional, national) and governmental.

also following suggestions have been offered:

- helping to marketing and establishing many exhibitions for member's productions, credit programs, guiding and training them in line with group and workshop activity, can assist them on economic empowerment.
- since women have pointed to education deficiency as major barrier for empowering them,

thus educating rural women at the field of exploiting different credits and channels of receiving credits, and also various educations, is so that lead to enabling them, that contain considerable importance.

- providing extension educations for men in order to believe economic role of their women, and give them chance of corporation on all economic, credits fields
- Since that base of credit association, forms base on People Corporation, so it's good chance to use these communities to expand extension-education activities. so it is better to consider special programs on different extensional fields such as agriculture, ranching, family health, housekeeping economy and other fields accordance to condition of region and rural women's needs.

- it is suggested that vast and exact programming happens at following fields:
  - a- extending insurance, facilities for amenities
  - b- educating women about awareness of their own individual and social rights
  - c- persuading rural women about importance of participating at cooperatives and other educational institutes
  - d- educating women about job management and income management

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**Financial support of rural women: an approach toward their empowerment**<sup>1</sup> Molouk Gharibpanah, <sup>2</sup> Azita Zamani<sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran

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**Abstract:** Global researches show that women played critical and important role at agriculture and now at most countries, they form major workforce of this part. In spite of importance of women workforce at different systems of agriculture, they have fewer access to development resources, compare to men. although during past two decades , various programs has been performed to enable women at agriculture , but due to different problems , gained success was very fewer than required extent . One of major problem in this filed is inadequate and inappropriate access to extensional services. Low efficiency of agriculture extension systems to provide services for rural women doesn't just refer to structure and function of these organizations and systems, but refer to other issues including research and cultural barriers in this field. However, one of essential needs to extend agriculture is, determining appropriate ways and approaches to educate women at every region or country. at many past decades , significant global efforts were done to provide educating how to access information , appropriate and effective technology for female farmers that led to positive effects on producing agricultural crops and consequently increasing family welfare.

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<http://www.americanscience.org>.

**Keywords:** empowerment, rural women, financial support

**Introduction:**

In all communities, rural women are considered as an important factor in achieving rural development goals and in fact are half of the manpower needed for rural development. However, in the rural community of Iran, there are gaps between the ruling class (capital owners) and villagers, between literate and illiterate, and between men and women. Especially in villages women have fewer possibilities in terms of investment and less power and credit. Role of rural women, over of men, is more influenced with different economic, social, cultural and ecologic factors. Rural women are considered as a noticeable potential in the community either directly (crops production, livestock, handicrafts, cottage industries) or indirectly by helping the agricultural sector (as labor). About 5.6 million women are involved in agricultural production, and activities related to planting... harvesting, preparation of animal food, and taking care of livestock and poultry and some certain activities related to trading and marketing are all different fields of rural women's role and participation. Based on current statistics, women in rural area participate about 50% in conversion industries, 22% in producing crops and livestock, 75% in handicrafts and in areas related to planting...harvesting , respectively, 25, 24 and 4.26. And also in activities related to livestock, they handle 23% of livestock grazing, 42% of animal care and 100 percent of total poultry in the village. Therefore their role in achieving food security is undeniable. But, like most developing countries, this crucial role in society and in process of rural

development, is not obvious. In Iranian rural community, about 80% of women work, but they are mostly considered as housewives, unpaid employment, domestic workers,

family workers, or independent employers. The statistics often do not take into account seasonal, part-time, unpaid employment, and housekeeping activities. In economics and social sciences, those of women's activities that have emerged out of house and affected national economy, are the ones to be noticed. In most research and statistics men are known as the heads of household and they are also the owners of lands and fields. That only 1% of the rural lands are belonging to women does confirm such matter (Samadi Afshar, 2004).

Development is a multidimensional process and has various economic, social, political and cultural dimensions. Rural women's participation has not been active and effective; because this participation's most important aspect, namely economics, is for rural women. However the value of their work in agricultural products is rarely considered as income and they are not independent either (Amiri, 2000).

For an active participation of women in development, first we need to give a definition for their role in development and then barriers related to their role will be discussed. Although apparently there is no difference of gender in development programs but reality is that women are less considered in participatory programs and most of these plans are planned for men. Finally, planner's optimistic look toward women's participation will be greatly helpful improve rural family budget and will increase the difference between urban and rural families. If, by credit, loans and other financial facilities, rural families are able to build up their own business and make a living through the income and become financially self-reliance or independent, no doubt we will witness some social, economic and cultural changes in villages (Varzgar and Azizi, 2001).



Rural women constitute about half of the world's population and in the world production supply they have energetic communion and constitute a great part of agriculture workforce. They constitute 50% of the workforce and they participate in the production of half of the foods in the agriculture section. As an example the rural women constitute about 70 to 80% of agriculture workforce in sub-Saharan Africa, 65% in Asia, 45% in Latin American & Caribbean, 80% in Nigeria & Tunisia and 80% in India, but their role in production system is the men's supplements roles and this causes a big responsibility inside their mother & wife duties and it takes a great time and energy of them. Studies in this field show that women spend about two thirds of their time for production, management & organize of their house as the men spend only one third of their time for such things. (Varzegar & Azizi 1367).

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Poverty spreading in village is a global issue. According to the Fao finding about 75% of world's poor people that are more than 1 milliard people are living in rural zone and more than 70% of this poverty people are women. As the most of the people who are poor are living in village and are women is the reason for insufficiency of rural development programs.

One of the other basic barriers in development of rural women is their independent inaccessibility to get credits for investment in their job. Although their illiteracy is the big barrier to use of bank credits, but this view that women are dependent people that their husband should decide about their financial decisions is the other reason that rural women couldn't access to official credits. Maybe these barriers are the reason why rural women are happy about applying micro-credit thought in village. (Najafi, 2007).

#### **Economic effects of rural women's financial self-reliance:**

it is possible that rural women's financial self-reliance made some crudities ( malformations) in the family for a short time, for example, rural women became proud after financial independency and find

the independence & Excellency sense in themselves but such problems will be small and for a short time.

The rural women's self-reliance has positive effects which is useful for women and their family and also will help their economic improvement that we will mention some of them. (Chowdhury, 2005).

#### **3-1- Self-reliance and financial independency:**

The income of the rural women makes them financially independent. The financial independency will let them to spend their wage in the ways that they like. Of course their dependency to their family won't let them to spend their wage out of their family needs. Because of this, their financial independency will let them and their family to be self-reliance. (Ghaffari, 2000).

#### **3-2- Change economic behavior:**

Although we are familiar with the rural women's role in the village and family's economic, but they direct & indirectly start a new economic relation, with finding modern jobs & financial independency. Catching loan from financial organizations has forced them to have economic schematization for loan reimbursement and to have intellectual economic behaviors. So after that rural women become active in economic activities. In rural traditional economic, women only have productive role and they don't have any role in economic planning, providence and they don't pay any attention to profits and losses. But in this new condition, for managing affairs in best way, the women have to be active in all of the affairs from production to dispense and also in others economic aspects. In other words, women will not be a productive only; they will contribute in managing of economic activities and will find various economic behaviors. . (Araghzadeh, 2002).

#### **3-3- Independency:**

The rural women will not dependent economically to their father or husband because of financial independency, this independency is very important to women who have children or they have lost their husband, because the financial problems have forced the rural women to have marriage which is not suitable for their children & themselves. Although the women can solve their financial problems with this kind of marriage but they will have many cultural, social & mental problems. If these women could manage their life with having a job, they can improve their family & kinship's relation.

The rural men & women should notice that their financial independency is not the meaning of an independency in their family, social & cultural affairs and making consensus between financial & economic affairs is necessary for family's consistency. (Fiona Steele et al, 2008).

#### **3-4- Help to economic growth**

The rural women's financial self-reliance will increase their motivation for finding a good job. As a result our rural & urban society will develop by working of women. And it will help direct & indirectly to our society's economic development. As the women constitute about half of the rural & urban's population, so by increasing their production, our society will develop economically. (Jameela, 2010).

#### **Micro-credits:**

One of the raised strategy , in order to accelerate investment process and reinforcing financial foundations , and saving , at deprived and rural areas , has been empowering and eradicating poverty of rural societies through efficiency with emphasize on applying micro-credits (Shahnaj and Sajedur, 2009). Micro-loans as useful tool to fight against poverty and starvation, has proven its capabilities and values to develop these areas. These tools have ability to change and improve human's life, especially poor peoples. Micro loans , saving accounts , and giving various bank services , cause this belief in low income and poor family that , by accessing to these services , their income will increase ,so they can protect themselves against barriers of unexpected problems and their current level of life and also invest on nutrition , housing and their children's education.( Varzgar and azizi, 2001)

Accessing to these conditions is among main goals of third millennium program (i.e. eradicating absolute poverty of human societies).

Nowadays micro-credits and supplying micro financial resources, has changed human's life and cause to revive different societies at poorest and richest countries of world, so that we can see growth in human's power to access to common financial services. By accessing to wide range of financial tools, families according to their priorities, invest on cases such as costs of education, healthcare, healthy and good nutrition or housing.

Applicants for Microfinance resources mostly involved family supervisor women, pensioners, homeless people, frugal workers, small farmers and micro entrepreneurs. These people are divided into four groups: Poor, very poor, relatively poor and vulnerable poor.

Whenever repayment afford , bond terms and accessing to data , in this classification will change , in order to supply sustainable financial needs of various clients , procedures and operation structures will be develop .( Fami, 2001)

Generally, in most countries, micro finance sources are considered for poor women. By women's access possibility to finance services, they committed to loan and ensure its repayment and preserve their

saving accounts and also enjoy insurance cover. Supplying programs for micro financial resources have strong message for families and societies. Most of qualitative and quantitative studies and researches have proven that accessing to financial services; will improve women's conditions in family and society. Women's confidence has increased and they are aware of their abilities. (Banihashem, 1999)

Thus, it has proven that supplying financial services for poor peoples is powerful tool to decrease poverty so that make them able to establish finance, increase income and decrease vulnerability against economic pressures.

In micro-credits programs other than offering and distributing micro loans, there are also small savings and deposits so that they are designed as form of saving-credit programs. The existing term in phrase "micro-credits" points to two basic concepts that is due to dominant perspective on this approach. First term (i.e. credits) points to rural areas and lack of access for many villagers to formal resources that are one of their major problems. And at system of micro-credits, are tried to decrease poor families' access barriers to credit sources and also to increase effectiveness of these markets. Second term (i.e. micro) emphasize on deficiency of development, according to classic economist's method. Emphasizing on concept of "micro" means revising recommendations of market economy at rural society's development.

Generally, goals of micro-credits programs are: (Moazami 2005)

- a- increasing access coefficient of low income rural women to credit facilities
- b- considering and focus on low income rural women groups
- c- empowering rural women to enjoy needed job skills
- d- empowering rural women to deal with group works and cooperative activity
- e- equipping non-productive villager's saving (women) to effective and productive investment
- f- planning in order to perform projects that are based on capacities and facilities of that area
- g- breaking poverty cycle and saving rural family
- h- Developing employment and stabilizing jobs which faced financial crisis

#### **Empowering rural women:**

Empowerment is capacity that woman can obtain in cultural and social environment, for economic independency and self reliance, by controlling over emotional decision making and far from violation. Empowering means, evolution and developing

activities through non governmental organizations (NGOS) that lead empowerment to improve economic dimensions. (Amiri, 2000)

Enabling is process that, during it, people of society do activities to overcome barriers of advancement that finally cause their domination to determine their own density. The term "enabling" means overcoming fundamental inequalities. So it is different from self-reliance. (UNICEF, 1997)

Enabling, enables individual to overcome any problematic condition and consider barriers and problems as part of life and positive campaign. Finally, enabling provides energy to overcome most intellectual barriers and external problems at private life.

Thus, among all what have been said, it is possible to present suitable definition of enabling women, as follows:

"Process of explaining women about themselves (and also men about them) for instances that they must or want to do, and growth of their willingness and courage until they reach to needed competency "(management of rural and tribal women).

it should be noted here , that major factor which should be considered about women's ability , is eliminating individual and social barriers , and finally preparing field of economic and social participation for women at all fields . purpose of women's participation , is because of their dominance on all affairs of village including decision making process , organizations , forums , enterprising posts and ... that involve , participation at all social and economic dimensions .

#### **Criteria of empowering women:**

Enabling as a theory of policy making for women, in it present five criteria:

Welfare, access, Concientisation, participation and control.

##### **1- welfare criteria :**

In this criteria, men and women as human resources of development should enjoy of desirable welfare conditions and equality (Paknazar, 2000).

Most of timing developmental programs, have worked on base of women's welfare. They have considered and provided some services for women who were passive recipient of these services. But these services were limited to physical needs and mostly were considered to revive their role of productivity, again. sometimes , it has been said that this approach has begun at colonial era and has considered women from poor country and intended services for them that dose not exceed from that poverty level . Agricultural and industrial projects were designed for men and social programs for women and children. Most of welfare programs were

inadequate or its success was limited. Considerable point in this criteria is that men and women as human resources of development should enjoy equality and desirable welfare conditions. At this stage, women's material welfare and their enjoyment of welfare programs, compared to men (nutrition, death rate and ...) were considered. And women's role as producer to supply their own needs isn't very important.

##### **2- access criteria :**

Lack of access or limited access for women to sources including (fields, job, capital and training) cause that their functions at production is less than men (Paknazar 2000). Access to facilities, sources, designed program and projects for women and access to schools and ... are in this part. Just whenever most of other legal, cultural and social issues being solved, men and women would equally access to sources and facilities. Concept of enabling at this stage is that women have equal right to access to sources at family and greater society.

##### **3- Concientisation criteria**

Women should know that their problems aren't due to their individual inefficiency and shortage but it has emerged by social system in which discriminations has become formal and acceptable issue. (Araghzadeh, 2002). This stage is more critical and important than other stages. Because women can participate at development activities not just be passive users. Women have real equality at development, just when be aware. Concientisation will help to increase women's ability to equality at participation at society. At this stage, women face with critical analysis with society and will find that what has been considered natural and unchangeable reality, is changeable. (Bakhshoodeh, 2005).

##### **4- Participation criteria**

One the most important items that this criteria has considered , is men and women's equal participation at decision making process of affairs of family at society (Paknazar 2000 ) . Men and women both should participate at process of assessment needs, designing, performing and evaluation of projects and development programs (UNICEF, 1998). In summary, this criterion means women's participation at all stages of surveying needs, detecting problems, planning, management, performing and valuation.

##### **5- Control criteria**

This criterion emphasize on this point that in addition to equal access of men and women to development sources , they must have adequate control on these sources that this issue is balance criterion , between men and women so that no one exceed other one (Paknazar 2000 ) . Women should have opportunities for decision making at workplace and home. If woman is producer, should be shared with part of her interest and wage. Women like men, should be able

to choose her individual and social field and able to make decision and also development activities should be facilitator of these processes.

FAO (food and agricultural organization) addresses these three purposes as strategic goals while enabling women:

- 1- equality between men and women to access production sources
- 2- women's participation at policy and decision making
- 3- decreasing rural women's workload and increasing job opportunity and income for them (Paknazar 2000 )

within theoretical framework of enabling women , having control on sources is presented as highest stage at women's participation process on development , but existing data at most developing countries , indicates that not only rural women haven't any control on financial resources of family but even they were deprived to access to sources and credits , specially through formal credits system (Shaditalab, 2002 ) .

The question that arises here is that what relation is there between enabling women and micro-credits programs? Nowadays, micro-credits are considered as effective mechanism to eradicate poverty for women. Interests of micro-credits further increasing women's income, include:

- improving women's role in family
- Increasing women's confidence, not only through obtain financial success through business activity, but through increasing women's access to social services and communication with other women.
- Changing at social level (social class) at perspective of women's role.

### Discussion and results:

In the new system of advanced agricultural economy, the value of women's work that previously was unpaid labor now must be paid in cash. Except for agriculture which is rural women's main work field they have rarely participated in tow other fields of economy. The most important issue of women's social and political participation is to take part in planning, decision making, implementation of decisions, and evaluation of results. Generally they have had a little share in such processes. Although in recent years rural women have participated more in villages' management, social and cultural organizations, and cooperative institutions' management; but having a lower level of literacy, education, income and social status than urban women they still have the smaller share of administrative and official jobs. Some barriers to women's participation which can be categorized in 3 groups of personal, familial, and social include: low literacy level, large volume of work

both inside and outside of home for many reasons including seasonal migration of men and the great diversity of rural women's activities(nursing, housekeeping, agriculture, handicrafts, livestock,...), malnutrition, low health indicator, Patriarchal structure of society, father or husbands disagreement with a woman's participation in social and economic activities for various reasons like cultural reasons or unwilling to lose the labor force at home, negative attitudes towards women's abilities, gender discrimination, family's poverty, superstitious beliefs, misleading customs like fatalism, low access of women to credit and facilities, inaccessibility of extension services, men-orientated social activities and participation plans, deficiency of professionals needed to educate rural women, problems of access to health services and social facilities, low income of rural women compared with men, lack of non-governmental organizations dealing with rural women's problems, few women managers in rural area. (Rahimi, 2001)

Nowadays, micro-credit and micro-financing have changed people's lives; it has brought back life to poorest and richest communities of the world. So we can easily observe a great increase in people's access to general financial services. Facilitating the access of families to financial services, they begin to invest on educational expenses, healthcare, healthy nourishment, trading, and housing based on their priorities. Overall in many countries financial plans mostly focus on women. Women, provided with financial facilities, will receive a loan, guarantee to pay it back, keep their saving account and also they'll have insurance coverage. Micro-financial plans have an important message for families and communities. Many studies have proven that women's access to mentioned facilities may improve their conditions in family and society; it also helps them feel more self-confident and makes them aware of their own abilities. Thus providing micro-credit services for the poor in society is a powerful tool to reduce poverty and so that they are able to create assets, earn more money and become less vulnerable against the economic pressure. Of about 1.3 billion poor in the world there are 900 million poor women, this obviously shows that poverty has a feminine face. According to UN's development fund, 10% of world's income and less than 10% of world's assets belongs to women. While a majority of them never possess the capital needed for their activities, women still play an important role in the economic development of country. Therefore women draw the micro-credit policy maker's attention more than others. Choosing women as the main target of micro-credit plans is an effective strategy to eradicate poverty; because their income will upgrade the family welfare; furthermore earning money improves their social status. In some countries this choice is influenced by society's attitude and culture (Araghzadeh, 2002).

For instance founder of Grumman Bank of Bangladesh, Mohammad Yunes, has stated that: "women have plans for themselves, their children, and their family life; they always

have an overlook while men just look for fun" to explain why 94% of their clients are women.

Women's access to micro-credits have shown that their income benefit to improve their family and provide livelihood. In addition to all these another reason of women being the target of micro-credit plans is that women have higher loan recovery rates. Totally, expanding women's access to micro-credits may lead to many useful results which in economy is mentioned as "virtuous spiral"; because their access to micro-credits results in family welfare and in a broader point it'll improve community's welfare and shall be increased welfare this process is repeated.

Ellen and her Colleagues (2009) used approach called it "credits and education at Bolivia, Ghana, Honduras, Mali and Thailand". This approach looks for empowering women through financial services with education. In this approach, women get familiar with importance of credits through education and extension and also familiar with ways to access it through establishing different groups.

Ruhal Amin and others (2010) found that those who joined credit funds had more ability rather than those who didn't.

Jameela (2010) presented that credit programs has shown lot of affects on empowering women so that has increased their social, politic and economic ability.

Thus it is obvious that credits programs and its educational and empowering programs can be affective on social, humane and economic development or rural society, if it be associated with proper and gradual practices and base on reciprocal communications principles and apply opinion of local society.

A study conducted by Chabokru et al (1384) shows the crucial importance of micro-credits for farmers who do not possess physical financial assets (land, building, livestock, well...) and work in agricultural sector because of environmental conditions (such as living in a village) or because it's their ancestral occupation.

So today, women's participation in sustainable economic, social, and cultural development in rural areas is not optional but an essential matter. Those communities that have not seriously considered the necessity of participation faced failures and delayed community's development, welfare and security process. In any community, village, or social group, broad participation of every women in decision-making and any other matter related to national or local development programs, is a key variable in social sciences and in the last few decades, it has interested many scholars of socio-economic and especially cultural issues, and is considered as one of the most fundamental democratic rights of women in a society. As we know in a popular participation, all people are given the opportunity to participate in planning and decision making for their society and for their own future. When in practice women feel that they can be involved in planning, policy making and deciding or solving problems in the society certainly they'll

feel more solidarity and become more interested in social, economic, and cultural development programs.

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**Programs for empowering rural women in Iran**Azita Zamani<sup>1</sup> and Nahideh Erfanirad<sup>2</sup><sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran\*Corresponding author: [mehran11070@yahoo.com](mailto:mehran11070@yahoo.com)

**Abstract:** In micro-credits programs other than offering and distributing micro loans, there are also small savings and deposits so that they are designed as form of saving-credit programs. The existing term in phrase “micro-credits” points to two basic concepts that is due to dominant perspective on this approach. First term (i.e. credits) points to rural areas and lack of access for many villagers to formal resources that are one of their major problems. And at system of micro-credits, are tried to decrease poor families' access barriers to credit sources and also to increase effectiveness of these markets. Second term (i.e. micro) emphasize on deficiency of development, according to classic economist's method. Emphasizing on concept of “micro” means revising recommendations of market economy at rural society's development.

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**Keywords:** Empowerment, Rural Women, IRAN

**Introduction:**

Rural women constitute about half of the world's population and in the world production supply they have energetic communion and constitute a great part of agriculture workforce. They constitute% 50 of the workforce and they participate in the production of half of the foods in the agriculture section. As an example the rural women constitute about 70 to% 80 of agriculture workforce in sub-Saharan Africa, %65 in Asia, %45 in Latin American & Caribbean, %80 in Nigeria & Tunisia and %80 in India, but their role in production system is the men's supplements roles and this causes a big responsibility inside their mother & wife duties and it takes a great time and energy of them. Studies in this field show that women spend about two thirds of their time for production, management & organize of their house as the men spend only one third of their time for such things. (Varzegar & Azizi 1367).

In the development countries, rural societies which are poverty for geographic reasons such as being far from urban societies or because of mountainous of zone and also as the roads are impassable and some other reason, they became deprived of many human development programs. Unfortunately these societies are suffering of mortality because of poverty but what is clear here is that we can't attribute such privation to geography and nature of the zone. Every country is trying to solve such critical conditions by applying depoverity policies. (Bakhshoodeh and Salami, 2005)

Poverty spreading in village is a global issue. According to the Fao finding about % 75 of world's poor people that are more than 1 milliard people are living in rural zone and more than % 70 of this poverty people are women. As the most of the people who are poor are living in village and are women is

the reason for insufficiency of rural development programs.

One of the other basic barriers in development of rural women is their independent inaccessibility to get credits for investment in their job. Although their illiteracy is the big barrier to use of bank credits, but this view that women are dependent people that their husband should decide about their financial decisions is the other reason that rural women couldn't access to official credits. Maybe these barriers are the reason why rural women are happy about applying micro-credit thought in village. (Najafi, 2007).

**Empowering rural women:**

Empowerment is capacity that woman can obtain in cultural and social environment, for economic independency and self reliance, by controlling over emotional decision making and far from violation. Empowering means, evolution and developing activities through non governmental organizations (NGOS) that lead empowerment to improve economic dimensions. (Amiri, 2000)

Enabling is process that, during it, people of society do activities to overcome barriers of advancement that finally cause their domination to determine their own density. The term “enabling” means overcoming fundamental inequalities. So it is different from self-reliance. (UNICEF, 1997)

Enabling, enables individual to overcome any problematic condition and consider barriers and problems as part of life and positive campaign. Finally, enabling provides energy to overcome most intellectual barriers and external problems at private life.

Thus, among all what have been said, it is possible to present suitable definition of enabling women, as follows:

“Process of explaining women about themselves (and also men about them) for instances that they must or want to do, and growth of their willingness and courage until they reach to needed competency “(management of rural and tribal women).

it should be noted here , that major factor which should be considered about women’s ability , is eliminating individual and social barriers , and finally preparing field of economic and social participation for women at all fields . purpose of women’s participation , is because of their dominance on all affairs of village including decision making process , organizations , forums , enterprising posts and ... that involve , participation at all social and economic dimensions .

### **Criteria of empowering women:**

Enabling as a theory of policy making for women, in it present five criteria:

Welfare, access, Concientisation, participation and control.

#### **1- welfare criteria :**

In this criteria, men and women as human resources of development should enjoy of desirable welfare conditions and equality (Paknazar, 2000).

Most of timing developmental programs, have worked on base of women’s welfare. They have considered and provided some services for women who were passive recipient of these services. But these services were limited to physical needs and mostly were considered to revive their role of productivity, again. sometimes , it has been said that this approach has begun at colonial era and has considered women from poor country and intended services for them that dose not exceed from that poverty level . Agricultural and industrial projects were designed for men and social programs for women and children. Most of welfare programs were inadequate or its success was limited. Considerable point in this criteria is that men and women as human resources of development should enjoy equality and desirable welfare conditions. At this stage, women’s material welfare and their enjoyment of welfare programs, compared to men (nutrition, death rate and ...) were considered. And women’s role as producer to supply their own needs isn’t very important.

#### **2- access criteria :**

Lack of access or limited access for women to sources including (fields, job, capital and training) cause that their functions at production is less than men (Paknazar 2000). Access to facilities, sources, designed program and projects for women and access to schools and ... are in this part. Just whenever most of other legal, cultural and social issues being solved, men and women would equally access to sources and facilities. Concept of enabling at this stage is that

women have equal right to access to sources at family and greater society.

### **3- Concientisation criteria**

Women should know that their problems aren’t due to their individual inefficiency and shortage but it has emerged by social system in which discriminations has become formal and acceptable issue. (Araghzadeh, 2002). This stage is more critical and important than other stages. Because women can participate at development activities not just be passive users. Women have real equality at development, just when be aware. Concientisation will help to increase women’s ability to equality at participation at society. At this stage, women face with critical analysis with society and will find that what has been considered natural and unchangeable reality, is changeable. (Bakhshoodeh, 2005).

### **4- Participation criteria**

One the most important items that this criteria has considered , is men and women’s equal participation at decision making process of affairs of family at society (Paknazar 2000 ) . Men and women both should participate at process of assessment needs, designing, performing and evaluation of projects and development programs (UNICEF, 1998). In summary, this criterion means women’s participation at all stages of surveying needs, detecting problems, planning, management, performing and valuation.

### **5- Control criteria**

This criterion emphasize on this point that in addition to equal access of men and women to development sources , they must have adequate control on these sources that this issue is balance criterion , between men and women so that no one exceed other one (Paknazar 2000 ) . Women should have opportunities for decision making at workplace and home. If woman is producer, should be shared with part of her interest and wage. Women like men, should be able to choose her individual and social field and able to make decision and also development activities should be facilitator of these processes.

FAO (food and agricultural organization) addresses these three purposes as strategic goals while enabling women:

- 1- equality between men and women to access production sources
- 2- women’s participation at policy and decision making
- 3- decreasing rural women’s workload and increasing job opportunity and income for them (Paknazar 2000 )

within theoretical framework of enabling women , having control on sources is presented as highest stage at women’s participation process on development , but existing data at most developing countries , indicates that not only rural women

haven't any control on financial resources of family but even they were deprived to access to sources and credits, specially through formal credits system (Shaditalab, 2002).

The question that arises here is that what relation is there between enabling women and micro-credits programs? Nowadays, micro-credits are considered as effective mechanism to eradicate poverty for women. Interests of micro-credits further increasing women's income, include:

- improving women's role in family
- Increasing women's confidence, not only through obtain financial success through business activity, but through increasing women's access to social services and communication with other women.
- Changing at social level (social class) at perspective of women's role.

If rural women could provide a job for them by getting credits, loan and other financial convenience, through their income they can get self-reliance or financial independency and we will see social, cultural & economic change in village. The question here is that if these changes have positive or negative aspects in the village? It's natural that every change in social phenomenon has both positive and negative aspect, but which is Important here is that which aspect is more than the other and it depends to different condition in various societies. In our rural society there is an especial social & cultural kind that it's outcome maybe different and in some case inconsistent. With these actions rural women could be in idealistic economic condition and they could live with out dependency to their husband's income. In most of the villages in Iran there is patriarchy in the families which is not acceptable for the most of the rural people and groups. When rural women became financially independent, it's acceptable to see its cultural & social outcomes.

Giving the right that women make decision, independency to their family, increasing the cultural knowledge among them& making relation with new institutions, having independency in making decision about marriage, occupation, migration & something like this are the right that women have got it.

Women by getting these rights can make change in the rural cultural & social issues which make disfunction & crudity in their family's relation. However, rural women's self-reliance has caused improvement in the economic, social & cultural issues. For solving women's self-reliance problems we can do these activities:

- Giving promotional services for increasing rural women's skills in various fields.

- Giving promotional instructions to men for believing their women's economic role & their women opportunity to participate in all economic, authority & ... aspects.
- Increasing rural women's knowledge in all social, political, cultural & economic fields.
- Making use of micro-credits programs to motivate & support women for doing economic affairs better & finally to make women self-reliance.

### Discussion and conclusion:

Ellen and her colleagues (2009) used approach called it "credits and education at Bolivia, Ghana, Honduras, Mali and Thailand". This approach looks for empowering women through financial services with education. In this approach, women get familiar with importance of credits through education and extension and also familiar with ways to access it through establishing different groups.

Shahnaj and chaudhury(2009) in research as "credits and its role on empowering women" concluded that there is meaningful relation between attending in credits programs and empowering women, at economical dimensions.

Ruhal amin and others (2010) found that those who joined credit funds had more ability rather than those who didn't.

In the new system of advanced agricultural economy, the value of women's work that previously was unpaid labor now must be paid in cash. Expect for agriculture which is rural women's main work field they have rarely participated in tow other fields of economy. The most important issue of women's social and political participation is to take part in planning, decision making, implementation of decisions, and evaluation of results. Generally they have had a little share in such processes. Although in recent years rural women have participated more in villages' management, social and cultural organizations, and cooperative institutions' management; but having a lower level of literacy, education, income and social status than urban women they still have the smaller share of administrative and official jobs. Some barriers to women's participation which can be categorized in 3 groups of personal, familial, and social include: low literacy level, large volume of work both inside and outside of home for many reasons including seasonal migration of men and the great diversity of rural women's activities(nursing, housekeeping, agriculture, handicrafts, livestock,...), malnutrition, low health indicator, Patriarchal structure of society, father or husbands disagreement with a woman's participation

in social and economic activities for various reasons like cultural reasons or unwilling to lose the labor force at home, negative attitudes towards women's abilities, gender discrimination, family's poverty, superstitious beliefs, misleading customs like fatalism, low access of women to credit and facilities, inaccessibility of extension services, men-orientated social activities and participation plans, deficiency of professionals needed to educate rural women, problems of access to health services and social facilities, low income of rural women compared with men, lack of non-governmental organizations dealing with rural women's problems, few women managers in rural area. (Rahimi, 2001)

Jameela (2010) presented that credit programs has shown lot of affects on empowering women so that has increased their social, politic and economic ability.

Thus it is obvious that credits programs and its educational and empowering programs can be affective on social, humane and economic development or rural society, if it be associated with proper and gradual practices and base on reciprocal communications principles and apply opinion of local society.

Maybe the main challenges that threaten credits associations , is lack of necessary emphasizes on social dimensions and on reinforcing their basics , that practically cause that this social foundations lose its efficiency soon and practically changed to unsuccessful institution .

also following suggestions have been offered:

- helping to marketing and establishing many exhibitions for member's productions, credit programs, guiding and training them in line with group and workshop activity, can assist them on economic empowerment.
- since women have pointed to education deficiency as major barrier for empowering them , thus educating rural women at the field of exploiting different credits and channels of receiving credits , and also various educations , is so that lead to enabling them , that contain considerable importance.
- providing extension educations for men in order to believe economic role of their women , and give them chance of corporation on all economic , credits fields
- Since that base of credit association, forms base on People Corporation, so it's good chance to use these communities to expand extension-

education activities. so it is better to consider special programs on different extensional filed such as agriculture , ranching , family health , housekeeping economy and other fields accordance to condition of region and rural women's needs .

- it is suggested that vast and exact programming happens at following fields:
  - a- extending insurance, facilities for amenities
  - b- educating women about awareness of their own individual and social rights
  - c- persuading rural women about importance of participating at cooperatives and other educational institutes
  - d- educating women about job management and income management

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## Improving performance and some metabolic response by using some antioxidants in laying diets during summer season.

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**Abstract:** The present work was conducted to define the effect of adding vitamin E (Vit. E) and/or selenium as seleno-yeast (SY) on performance, egg quality and some blood constituents of laying hens during summer months. Two hundred seventy Hi- sex Brown layers in their 25 weeks of age were randomly divided into nine dietary treatment groups. Each treatment included thirty hens in 6 replicates (5 birds/each). The obtained results showed that dietary Vit.E at either level 0.20 or 0.40mg/kg considerably resulted in positive significant effect on egg production (EP) values and had no effect on egg weight (EW) compared to the control. Also, feed intake (FI) did not differ while, feed conversion (FC) values were improved due to Vit.E addition compared to the control. However, dietary organic se (SY) achieved significant increase on EP values but no differences on EW and FI values, while FC achieved the best values by adding SY as compared to the control. Both levels of Vit.E significantly improved shell-thickness and decreased shape index and yolk color than the control, whereas, no effects were observed on egg quality parameters due to SY addition, except, yolk index which improved compared to the control. On the other hand, plasma total protein (TP), albumin (Alb) and globulin (GLO) were significantly increased by adding Vit.E but AST, ALT and glutathione peroxidase were not affected versus to SY addition which caused significant effects on ALT and glutathione peroxidase and increased with the higher level of SY. There were significant interactions due to Vit.E x SY addition concerning the performance (EP, EW, FI and FC), most egg quality parameters (shape index, Haugh units and yolk index) and some blood plasma (TP, Alb, Glo. and glutathione peroxidase) to laying hens diets. So, it could be recommended that adding either Vit. E and/or selenium enriched yeast (SY) as antioxidants were found to be effective on improving laying performance and could be beneficial during the summer season.

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**Keywords:** Improving performance, Blood metabolic, laying diets, summer season.

### 1. Introduction

Vitamin E (Vit.E) is a metabolic nutrient that has received a lot of attention with respect to its importance to the immune response in poultry. However, chicken cannot synthesis Vit.E, therefore, Vit.E requirements must be given from dietary sources (Chan and Decker, 1994). Also, Vit.E has been reported an excellent biological functions as natural antioxidant prevents the oxidation of unsaturated lipid materials within cells, thus protecting the cell membrane oxidative damage (Gore and Qureshi, 1997). Furthermore, Vit.E serves as a physiological antioxidant through inactivation free radicals, improves egg production, feed intake, egg yolk and albumen solids (Kirunda et al., 2001), and improves egg quality (Puthongsirporn, 1998).

On the other hand, selenium (Se) has been recognized as an essential nutrient required for laying hens for normal growth, maintenance of health and physiological functions. The role of Se in biological systems has been associated with its antioxidant activity (Schwary and Foltz, 1957), while its physiological importance was recognized when it is found to be an essential structural of the glutathione

peroxidase enzymes (Rotruck et al., 1973) that destroy free radicals produced during normal metabolic activity (Wakebe, 1998 and Dvorska et al., 2003). The use of seleno-yeast (SY) in laying hens is very effective for increasing the Se content of egg (Cantor et al., 2000; Payne et al., 2005 and Utterback et al., 2005). However, Se can affect egg quality where, it can ameliorate some of the adverse effects of strong Haughunit value of eggs (Pappas et al., 2005). Also, it may affect metabolism and production because it is essential for the synthesis of active thyroid hormones, while, no differences in egg production, egg weight, feed intake or mortality by using organic SY which is very effective for increasing the Se content of eggs (Utterback et al., 2005). Therefore, adding Se to laying diets improves their health, productivity and can also be a natural way to produce functional food respectivity the production of egg enriched with Se (Yaroshenko et al., 2003 and Sara et al., 2008), which represents a commercially valuable use for the future.

The action of Se is closely linked with that of Vit.E. Vitamin E as a natural antioxidant, prevent the development of peroxides, while Se as a constituent of glutathione peroxidase function in the disposal of any

peroxides that are formed. Due to the metabolic relationship between Vit.E and Se (Cook, 1991), it is essential that both nutrients be considered together when discussing their effects on productivity and immunity (Salwa Siam et al., 2005). So, the objective of this study was to establish the effects of Vit.E and/or SY to alleviate heat load on performance, egg quality and some biochemical blood parameters of laying hens under summer season in Egypt.

## 2. Material and Methods

This experiment was conducted to study the effect of different levels of vitamin E (VE) and /or selenium as seleno-yeast (SY) addition in laying hens diets during summer season (June, July and August) in Egypt. Two hundred seventy, 25-weeks old, Hi-sex brown-egg type hens housed in individual wire cages, and divided into nine equal treatment groups of twenty five hens each (6 replicates of five birds each). All hens were kept under the same managerial, hygienic and environmental temperature which ranged from 22 to 38°C and humidity from 40-60% during over all the experimental intervals (3 periods of 4 weeks each). Also, the lighting schedule was 16 h light: 8h dark/day. Hens received an iso-caloric and iso-nitrogenous (2819 ME Kcal/kg and 18% CP). Basal diet (Table 1), balanced to meet requirements of laying hens (NRC, 1994). The experimental groups were fed on one of the following diets:

- T1: 0.0 mg/kg VE + 0.0% SY (control).
- T2: T1 + 0.0 mg/kg VE + 0.25% SY.
- T3: T1 + 0.0 mg/kg VE + 0.50% SY.
- T4: T1 + 0.20 mg/kg VE + 0.0% SY.
- T5: T1 + 0.20 mg/kg VE + 0.25% SY.
- T6: T1 + 0.20 mg/kg VE + 0.50% SY.
- T7: T1 + 0.40 mg/kg VE + 0.0% SY.
- T8: T1 + 0.40 mg/kg VE + 0.25% SY.
- T9: T1 + 0.40 mg/kg VE + 0.50% SY.

Feed and water offered ad-libitum. Egg weight (EW) and egg number (EN) were recorded daily. Feed intake (FI) was recorded weekly, while feed conversion ratios (FCR) were calculated. Egg quality parameters were measured using 36 eggs (4 eggs/each group), these involved yolk, albumen, shell weight (%). Egg shell thickness was measured in mm using a micrometer. Egg shape index was calculated as egg diameter divided by an egg length. Yolk index was calculated as yolk height divided yolk diameter. Haugh unit was calculated using the calculation chart for rapid conversion of EW and albumen height.

At the end of the experiment, blood samples were collected in heparinized tubes from the brachial vein (5 hens /group), and centrifuged at 3000rpm for 15 minutes to separate clear serum which stored at 20°C for determination of some blood constituents. Also,

glutathione peroxidase concentration was determined by spectrophotometer using available commercial kits.

Data were analyzed using general linear model (GLM) procedure of statistical system (SPSS, 1997). Significant differences among individual means were analyzed by Duncan's multiple range test (Duncan, 1955).

## 3. Results and discussion

### Productive performance:

#### Egg production (EP) and egg weight (EW):

As shown in Table 2, the results indicated that hens fed diets added with Vit.E had significant improvement in values of EP (%) when compared to the control. However, the hens fed 40mg/kg Vit.E had the highest EP (%) as compared to the other treatments and control group during the third period and the whole experimental period. Furthermore, EW had the same trend, when Vit.E was added up to 40 mg/kg in laying diets showing the best values of EW during the third period and the whole experimental period. In this respect, Abdel- Maksoud (2006) showed that supplemental Vit.E increased EP(%) by alleviating the adverse effects of high ambient temperature in laying hens during summer months. However, Vit.E supplementation may have enhanced synthesis of egg yolk precursors in liver through protecting the liver from lipid peroxidation and damage to cell membranes. This was previously confirmed in hens by Bollengier-lee et al. (1998 and 1999). Similar results were obtained in laying Japanese quail reared under heat stress (34°C) by Sahin et al. (2002), Abdel-Galil and Abdel-Samad (2004) and Ciftci et al. (2005).

On the other hand, hens fed diets added with organic Se as SY recorded significantly higher values of EP (%) when compared to the control. This improvement of EP increased by increasing SY level. In addition, dietary SY levels had no significant effect on EW during over all experimental periods comparable to the control. Similar results were obtained by Renema (2004), Simon (2004) and Sara et al. (2008), they showed that addition of organic Sel-Plex to laying hens diets significantly ( $P < 0.05$ ) increased EP(%) during the period ranged from 48-62 wk of age respectively. Similar trend was observed by Hanafy et al. (2009). However, Utterback et al. (2005) found that no significant differences ( $P < 0.05$ ) in EW was attained with basal diet plus either sodium selenate or seleno-yeast.

Significant interactions between Vit.E x SY additives (Table 2) were observed for EP and EW values, where, the highest EP was attained with high SY level (T9). Also, each of tested additives significantly ameliorated EP compared to the control. The highest value was for T3, followed by T6 and T9 which received a combination of Vit.E and SY diets

during the tested periods. While, EW values were nearly similar between treatments and had no significant effect due to the tested additives during the whole period values. In this connection, Vit.E is effective antioxidant that protect cells from oxidative stress induced by free radicals (Bartov and Frigg, 1992), through scavenging the free radical (Zuprizal et al., 1993), transferring radical equivalents from lipid phases to aqueous compartment (Halliwell and Gutteridge, 1989) or increasing the expression of antioxidant enzymes such as glutathione (Luadicina and Marnett, 1990).

#### **Feed intake (FI) and feed conversion (FC):**

Results in Table 3, showed that adding Vit.E at different levels in laying hen diets was not achieved any significant increase in FI values as compared to the control diet throughout the different intervals and the total period. The non-significant differences in FI indicate the positive effect of Vit.E was mainly due to feed utilization. With respect to FC, the values were markedly improved ( $P < 0.05$ ) due to Vit.E addition in laying hen diets. The hens fed Vit. E up to 40mg/kg diet had significantly ( $P < 0.05$ ) better FC values during the 3 tested periods compared to the other and control ones. Similar trends were reported by Bollengier-lee et al. (1999) and Sahin et al. (2002) in Japanese quail, and Metwally (2003) on laying hens. Vitamin E might play an important role through the protection of liver and other organs against oxidative damage (as a metabolic regulator) as cited by Abdel-Maksoud (2006).

Furthermore, no significant effects of SY addition and with increasing level on FI were observed during all tested periods. Hens of T3 (fed 0.50% SY) showed the highest FI values. These results are supported by Payne et al. (2005), Utterback et al. (2005), Richter et al. (2006) and Hanafy et al. (2009), they reported that the organic Se supplementation had no significant effect on FI values in laying hens. However, the group fed diet containing SY improved FC, the best value was achieved by hens of T3 compared to the control value. Our results disagree with those of Osman et al. (2010) who found no significant effect in FC values for hens fed diet containing 100 or 200mg Se/kg diet as Sel-plex during the overall experimental period. A significant interaction between Vit.E x SY was noted in FI values (T5, T6, T8 and T9). Also the best ( $P < 0.05$ ) FC value was attained by T9, T8 and T6 followed by each of Vit.E and SY treatments, respectively.

#### **Egg Quality Parameters:**

As shown in Table 4, most egg quality parameters were not affected ( $P < 0.05$ ) by the treatments except, shape index and yolk color which significantly ( $P < 0.05$ ) decreased and shell thickness

which significantly ( $P < 0.05$ ) improved compared to the control. These results confirmed those of El-Shikh and Salama (2010) who reported that Vit E improved shell-thickness and haugh unit score as compared to the control but, did not affect significantly shell weight% and albumen weight % as compared to control. Similar results were reported by Engelmann et al. (2001), Kirunda et al. (2001) and Abdel-Galil and Abdel-Samad (2004). In this connection, the achieved improvement in shell-thickness could be due to enhancement of calcium bioavailability by the action of supplemental Vit.E. These facts confirmed the results of increased serum-calcium concentration that has been established in the present study (Abdel-Fattah and Abdel-Azeem, 2007). Moreover, Vit.E addition was stated to influence the oestradiol dependant mechanisms by exerting a direct effect on oestradiol or indirect effect through maintaining more normal function of cellular processes regulating oestradiol and restoration of estrogen secretion (Bollengier-lee et al., 1998). Concerning SY level, no significant ( $P < 0.05$ ) differences were found on egg quality parameters. Only the yolk index showed the significant effect ( $P < 0.05$ ) by using diets containing SY. These results are in agreement with Klecker et al. (2001), Renema (2006) and Sara et al. (2008), they reported that the administration of organic Se in laying hen diets increased shell-thickness consequently improved egg shell quality. Similar reports by Spring (2006) and Hanafy et al. (2009). However, SY addition, reduced deterioration of the albumen quality which results in slower carbon dioxide loss and thus maintains albumen quality after the egg is laid (Wakebe, 1998).

Shape index significantly ( $P < 0.05$ ) improved with Vit.E and/or SY addition. The highest being for T2 (0.25% Se), T7 (50 mg/kg Vit.E) compared to T1 (control group). On the other hand, there were significant interactions due to tested additives for shape index, haugh units and yolk index, where, the highest shape index was attained by T6 while haugh unit score and yolk index were improved by T9 and T6 compared to the control. The improvement of haugh units in this study may be explained by the interaction of dietary Vit.E with SY. Experimental results obtained are in harmony with those reported by Spring (2006) who indicated that organic Se supplementation in broiler and breeder layers improved egg quality and anti-oxidative properties.

#### **Some Blood Constituents:**

The results in Table 5 showed that hens fed diet added with Vit.E up to 0.50mg/kg had significant ( $P < 0.05$ ) increased on blood serum TP., Alb., and globuline, whereas no effect ( $P < 0.05$ ) on serum AST, ALT, triglycerides and glutathione peroxidase comparing to the control during summer months of the experiment. These results supported to those of Gursu

et al. (2003) who found that serum activities of AST and ALT were not influenced by dietary Vit.E supplementation. But through its known properties as an intra-membrane antioxidant, Vit.E may protect tissue membrane from lipid peroxidation caused by free radicals attack. It could therefore reduce the associated loss of integrity of function of cell membranes and associated increased cellular permeability and play a role in alleviating the effect of heat stress in laying hens.

However, the addition SY in the differences in the laying diets at 20-40mg/kg caused significant differences in ALT, TP, GLO and glutathione peroxidase, while in-significant effects in the other blood parameters being in AST, triglycerides, cholesterol and albumin compared to the control. Also, organic Se (SY) had more pronounced effect on TP, GLO and glutathione peroxidase. In this connection, Kim and Mahan (2003) indicated that Se is bio-chemically similar to sulphur, where, Se can replace the sulphur molecule in the normal biosynthetic pathway of the yeast cell and is absorbed activity across the intestine by the same amino acid carrier. Furthermore, organic Se addition to broiler breeder and layers was activity absorbed and can be directly incorporated into protein (Comb and Comb, 1986). On the other hand, the significant increase in serum

glutathione peroxidase was due to Se addition in the laying diets.

The use of Sel-plex as a source of supplemental dietary Se provides a more efficiency utilized form of organic Se and facilitates a greater antioxidant enzymes presence in glutathione peroxidase which more readily reduced peroxides and other free radicals compromise cell membranes (Edens and Gowdy, 2005).

From Table (5), significant interactions between Vit.E x SY were found for TP, ALB, GLO and glutathione peroxidase to laying hens diets (i.e. T5, T6, T8 and T9, respectively). These additions alleviated the adverse effect of hot climate on AST and ALT. This improvement may be due to that both Vit.E and Se are involved in the formation of glutathione peroxidase, a compound vital in the cellular detoxification mechanisms.

It could be concluded that, either Vit. E or Se-enriched yeast (SY) alone or in combination recorded greater results of the performance, egg quality and some blood parameters in laying hens and the higher levels of these additions was suitable to cover the requirements without adverse effects on laying hens. So, adding Vit. E and/or SY levels in the present study were found to be effective in improving the laying performance.

Table (1): Composition of the experimental ration.

Ingredients (%)	%
Yellow corn	63.00
Soybean meal (44% CP)	18.00
Corn gluten meal (60% CP)	8.00
Limestone (CaCo <sub>3</sub> )	7.50
Bone meal	2.50
Vit & Mineral Premix*	0.30
Salt (NaCl)	0.4
L-Lysine HCl	0.15
DL-Methionine	0.15
Total	100.00
<b>Calculated analysis:</b>	
Crude protein %	18.08
ME (Kcal/Kg diet)	2810
Calcium %	3.67
Available phosphorous %	0.43
Lysine %	0.73
DL-Methionine %	0.35

\* Vit. & Min. mixture: Each kilogram of Vit. & Min. mixture contains: 2000.000 IU Vit. A, 150.000 IU Vita. D, 8.33 g Vit. E, 0.33 g Vit.K, 0.33 g Vit.B<sub>1</sub>, 1.0 g Vit.B<sub>2</sub>, 0.33g Vit.B<sub>6</sub>, 8.33 g Vit.B<sub>5</sub>, 1.7 mg Vit. B<sub>12</sub>, 3.33 g Pantothenic acid, 33 mg Biotin, 0.83g Folic acid, 200 g Choline chloride, 11.7 g Zn, 12.5 g Fe, 16.6 mg Se, 16.6 mg Co, 66.7 g Mg and 5 gMn



Table (2): Egg production and Egg weight in laying hen diets as affected by dietary Vit. E and/or Se addition during different periods.

Item	1 <sup>st</sup> Period		2 <sup>nd</sup> Period		3 <sup>rd</sup> Period		Hole Period	
	Egg production%	Egg weight, gm	Egg production%	Egg weight, gm	Egg production%	Egg weight, gm	Egg production%	Egg weight, gm
Seleno-yeast effects								
0 %	77.73 <sup>b</sup>	60.00	84.26 <sup>b</sup>	61.16	84.21 <sup>b</sup>	61.34	82.07 <sup>b</sup>	60.85
0.25%	79.72 <sup>ab</sup>	59.90	84.26 <sup>b</sup>	61.11	85.83 <sup>b</sup>	61.43	83.27 <sup>b</sup>	60.84
0.50%	82.18 <sup>a</sup>	60.08	87.31 <sup>a</sup>	61.13	89.03 <sup>a</sup>	61.42	86.17 <sup>a</sup>	60.90
Vitamin E effects								
0 mg/Kg.	79.26	59.97	84.40	61.18	84.31 <sup>b</sup>	61.47 <sup>ab</sup>	82.65	60.89 <sup>ab</sup>
20 mg/Kg.	79.86	59.90	85.28	61.06	87.18 <sup>a</sup>	61.25 <sup>b</sup>	84.10	60.76 <sup>b</sup>
40 mg/Kg.	80.51	60.11	86.16	61.15	87.59 <sup>a</sup>	61.48 <sup>a</sup>	84.75	60.94 <sup>a</sup>
Seleno-yeast X Vitamin E								
T1	75.14 <sup>c</sup>	60.10	80.42 <sup>b</sup>	61.33 <sup>a</sup>	79.58 <sup>c</sup>	61.51 <sup>a</sup>	78.38 <sup>c</sup>	60.99
T2	79.03 <sup>abc</sup>	59.92	83.89 <sup>ab</sup>	60.95 <sup>b</sup>	82.92 <sup>bc</sup>	61.43 <sup>ab</sup>	81.94 <sup>bc</sup>	60.79
T3	83.61 <sup>a</sup>	59.90	88.89 <sup>a</sup>	61.27 <sup>ab</sup>	90.42 <sup>a</sup>	61.46 <sup>ab</sup>	87.64 <sup>a</sup>	60.90
T4	77.64 <sup>bc</sup>	59.91	87.22 <sup>a</sup>	61.12 <sup>ab</sup>	86.67 <sup>ab</sup>	61.05 <sup>b</sup>	83.84 <sup>ab</sup>	60.72
T5	80.14 <sup>abc</sup>	59.82	83.61 <sup>ab</sup>	61.12 <sup>ab</sup>	87.64 <sup>ab</sup>	61.33 <sup>ab</sup>	83.80 <sup>ab</sup>	60.78
T6	81.81 <sup>ab</sup>	59.98	85.00 <sup>ab</sup>	60.94 <sup>b</sup>	87.22 <sup>ab</sup>	61.35 <sup>ab</sup>	84.68 <sup>ab</sup>	60.77
T7	80.42 <sup>abc</sup>	60.00	85.14 <sup>ab</sup>	61.02 <sup>ab</sup>	86.39 <sup>ab</sup>	61.47 <sup>ab</sup>	83.98 <sup>ab</sup>	60.85
T8	80.00 <sup>abc</sup>	59.97	85.28 <sup>ab</sup>	61.27 <sup>ab</sup>	86.94 <sup>ab</sup>	61.53 <sup>a</sup>	84.07 <sup>ab</sup>	60.95
T9	81.11 <sup>ab</sup>	60.36	88.06 <sup>a</sup>	61.17 <sup>ab</sup>	89.44 <sup>a</sup>	61.45 <sup>ab</sup>	86.20 <sup>ab</sup>	61.02
Overall mean± SE.	79.88 ± 0.62	59.99 ± 0.06	85.28 ± 0.62	61.13 ± 0.04	86.36 ± 0.65	61.40 ± 0.05	83.84 ± 0.53	60.86 ± 0.03

a, b, c. Means with different superscript in the same column for the same item differ significantly ( p < 0.05).

Table (3): Feed intake and feed conversion in laying hen diets as affected by dietary Vit. E and/or Se addition during different periods.

Item	1 <sup>st</sup> Period		2 <sup>nd</sup> Period		3 <sup>rd</sup> Period		Hole Period	
	Feed intake, gm/hen	Feed conversion	Feed intake, gm/hen	Feed conversion	Feed intake, gm/hen	Feed conversion	Feed intake, gm/hen	Feed conversion
Seleno-yeast effects								
0 %	125.16	2.43 <sup>a</sup>	124.91	2.42 <sup>a</sup>	121.35	2.43 <sup>a</sup>	125.16	2.43 <sup>a</sup>
0.25%	122.67	2.38 <sup>b</sup>	124.61	2.36 <sup>b</sup>	120.23	2.37 <sup>b</sup>	122.67	2.38 <sup>b</sup>
0.50%	126.18	2.36 <sup>b</sup>	127.85	2.34 <sup>c</sup>	123.57	2.35 <sup>c</sup>	126.18	2.36 <sup>c</sup>
Vitamin E effects								
0 mg/Kg.	115.93	2.44 <sup>a</sup>	125.07	2.42 <sup>a</sup>	125.11	2.42 <sup>a</sup>	122.03	2.43 <sup>a</sup>
20 mg/Kg.	113.84	2.38 <sup>b</sup>	124.42	2.39 <sup>b</sup>	126.53	2.37 <sup>b</sup>	121.60	2.38 <sup>b</sup>
40 mg/Kg.	114.32	2.36 <sup>b</sup>	124.52	2.36 <sup>c</sup>	125.74	2.34 <sup>c</sup>	121.52	2.35 <sup>c</sup>
Seleno-yeast X Vitamin E								
T1	114.26	2.54 <sup>a</sup>	121.89 <sup>ab</sup>	2.47 <sup>a</sup>	120.53 <sup>b</sup>	2.46 <sup>a</sup>	118.89 <sup>b</sup>	2.49 <sup>a</sup>
T2	113.53	2.40 <sup>bc</sup>	123.21 <sup>ab</sup>	2.41 <sup>ab</sup>	121.63 <sup>b</sup>	2.39 <sup>b</sup>	119.45 <sup>b</sup>	2.40 <sup>bc</sup>
T3	119.99	2.40 <sup>bc</sup>	130.11 <sup>a</sup>	2.39 <sup>b</sup>	133.17 <sup>a</sup>	2.40 <sup>b</sup>	127.75 <sup>a</sup>	2.39 <sup>bc</sup>
T4	111.88	2.41 <sup>b</sup>	129.35 <sup>ab</sup>	2.43 <sup>ab</sup>	127.39 <sup>ab</sup>	2.41 <sup>b</sup>	122.87 <sup>ab</sup>	2.41 <sup>bc</sup>
T5	114.02	2.38 <sup>bc</sup>	121.64 <sup>b</sup>	2.38 <sup>b</sup>	127.85 <sup>ab</sup>	2.38 <sup>b</sup>	121.17 <sup>b</sup>	2.38 <sup>bc</sup>
T6	115.64	2.36 <sup>bc</sup>	122.28 <sup>ab</sup>	2.36 <sup>b</sup>	124.36 <sup>b</sup>	2.32 <sup>c</sup>	120.76 <sup>b</sup>	2.35 <sup>c</sup>
T7	115.83	2.40 <sup>b</sup>	124.24 <sup>ab</sup>	2.39 <sup>b</sup>	126.82 <sup>b</sup>	2.39 <sup>b</sup>	122.30 <sup>ab</sup>	2.39 <sup>bc</sup>
T8	112.69	2.35 <sup>bc</sup>	123.17 <sup>ab</sup>	2.36 <sup>b</sup>	124.36 <sup>ab</sup>	2.32 <sup>c</sup>	120.07 <sup>b</sup>	2.34 <sup>c</sup>
T9	114.43	2.34 <sup>c</sup>	126.15 <sup>ab</sup>	2.34 <sup>c</sup>	126.03 <sup>ab</sup>	2.29 <sup>c</sup>	122.20 <sup>ab</sup>	2.32 <sup>c</sup>
Overall mean± SE.	114.70 ± 0.84	2.40 ± 0.01	124.67 ± 0.87	2.39 ± 0.01	125.79 ± 0.90	2.37 ± 0.01	121.72 ± 0.69	2.39 ± 0.01

a, b, c. Means with different superscript in the same column for the same item differ significantly ( p < 0.05).

Table (4): Egg quality parameters of laying hens as affected by dietary Vit.E and/or Se addition during summer season. a, b, c. Means with different superscript in the same column for the same item differ significantly (  $p < 0.05$ ).

Item	Egg weight	Shape index	Haugh unit	Yolk color	Albumin %	Yolk %	Shell %	Yolk index	Shell thickness
<b>Vitamin E effects</b>									
<b>0 mg/Kg.</b>	59.29	79.06 <sup>a</sup>	85.29	8.67 <sup>a</sup>	60.79	26.89	12.32	40.54	35.42 <sup>ab</sup>
<b>20 mg/Kg.</b>	61.08	76.84 <sup>b</sup>	86.75	7.83 <sup>ab</sup>	61.18	26.19	12.62	43.79	36.58 <sup>a</sup>
<b>40 mg/Kg.</b>	59.42	76.58 <sup>b</sup>	88.75	7.67 <sup>b</sup>	62.12	26.38	11.50	42.26	32.92 <sup>b</sup>
<b>Seleno-yeast effects</b>									
<b>0 %</b>	58.97	77.79	83.33	8.17	61.62	26.24	12.14	43.04 <sup>ab</sup>	34.67
<b>0.25%</b>	60.08	78.01	88.17	7.92	61.59	26.64	11.77	39.68 <sup>b</sup>	35.08
<b>0.50%</b>	60.83	76.67	89.33	8.08	60.88	26.59	12.53	43.86 <sup>a</sup>	35.17
<b>Seleno-yeast X Vitamin E</b>									
<b>T1</b>	57.50	78.63 <sup>ab</sup>	79.50 <sup>b</sup>	8.75	61.75	26.75	11.68	41.46 <sup>abc</sup>	34.50
<b>T2</b>	61.00	81.50 <sup>a</sup>	91.75 <sup>ab</sup>	8.50	60.29	27.48	12.23	41.09 <sup>abc</sup>	34.75
<b>T3</b>	59.25	77.04 <sup>b</sup>	84.75 <sup>ab</sup>	8.75	60.33	26.63	13.04	39.06 <sup>bc</sup>	37.00
<b>T4</b>	61.00	76.52 <sup>b</sup>	83.00 <sup>ab</sup>	8.00	61.05	25.85	13.10	43.83 <sup>ab</sup>	38.00
<b>T5</b>	59.75	76.31 <sup>b</sup>	86.25 <sup>ab</sup>	7.75	60.70	27.15	12.15	41.77 <sup>abc</sup>	34.50
<b>T6</b>	62.50	77.69 <sup>ab</sup>	91.00 <sup>ab</sup>	7.75	61.80	25.58	12.62	45.78 <sup>ab</sup>	37.25
<b>T7</b>	58.00	78.22 <sup>ab</sup>	87.50 <sup>ab</sup>	7.75	62.08	26.30	11.62	43.84 <sup>ab</sup>	31.50
<b>T8</b>	59.50	76.23 <sup>b</sup>	86.50 <sup>ab</sup>	7.50	63.77	25.29	10.94	36.18 <sup>c</sup>	36.00
<b>T9</b>	60.75	75.28 <sup>b</sup>	92.25 <sup>a</sup>	7.75	60.51	27.55	11.93	46.75 <sup>a</sup>	31.25
<b>Overall mean ± SE.</b>	59.92 ±0.69	77.49 ±0.46	86.94 ±1.29	8.06 ±0.17	61.36 ±0.44	26.49 ±0.31	12.15 ±0.25	42.20 ±0.84	34.97 ±0.72

Table (5): Some blood plasma constituents in laying hens as affected by dietary Vit.E and/or Se addition.

Item	Got U/dl	Gpt U/dl	Triglesred Mg/dl	Cholesterol Mg/dl	T. Protein g/dl	Albumin g/dl	Globulin g/dl	A/G ratio	Glutathione Peroxidase Mg/L
<b>Vitamin E effects</b>									
<b>0 %</b>	27.33	115.92	340.58	130.25	4.15 <sup>b</sup>	1.84 <sup>b</sup>	2.32 <sup>b</sup>	0.80	0.070
<b>0.25%</b>	31.00	115.50	322.58	126.25	4.42 <sup>b</sup>	2.07 <sup>a</sup>	2.35 <sup>b</sup>	0.89	0.072
<b>0.50%</b>	30.58	111.25	510.33	125.67	4.73 <sup>a</sup>	2.07 <sup>a</sup>	2.66 <sup>a</sup>	0.79	0.074
<b>Seleno-yeast effects</b>									
<b>0 mg/Kg.</b>	31.75	121.17 <sup>a</sup>	522.92	126.25	4.25 <sup>b</sup>	1.94	2.31 <sup>b</sup>	0.85	0.056 <sup>b</sup>
<b>20 mg/Kg.</b>	29.17	116.50 <sup>ab</sup>	328.08	120.75	4.28 <sup>b</sup>	1.94	2.34 <sup>b</sup>	0.84	0.077 <sup>a</sup>
<b>40 mg/Kg.</b>	28.00	105.00 <sup>b</sup>	322.50	135.17	4.78 <sup>a</sup>	2.09	2.69 <sup>a</sup>	0.79	0.083 <sup>a</sup>
<b>Vitamin E X Seleno-yeast</b>									
<b>T1</b>	28.50	130.75 <sup>a</sup>	387.50	125.00 <sup>ab</sup>	3.66 <sup>c</sup>	1.57 <sup>c</sup>	2.09 <sup>c</sup>	0.76 <sup>b</sup>	0.051 <sup>b</sup>
<b>T2</b>	29.25	105.75 <sup>ab</sup>	328.25	125.50 <sup>ab</sup>	4.18 <sup>cde</sup>	1.99 <sup>cd</sup>	2.19 <sup>bc</sup>	0.91 <sup>ab</sup>	0.078 <sup>a</sup>
<b>T3</b>	24.25	111.25 <sup>ab</sup>	306.00	140.25 <sup>ab</sup>	4.63 <sup>bc</sup>	1.96 <sup>cd</sup>	2.67 <sup>ab</sup>	0.74 <sup>b</sup>	0.080 <sup>a</sup>
<b>T4</b>	35.25	123.75 <sup>ab</sup>	313.50	113.50 <sup>b</sup>	4.92 <sup>ab</sup>	2.49 <sup>a</sup>	2.44 <sup>bc</sup>	1.04 <sup>a</sup>	0.058 <sup>b</sup>
<b>T5</b>	29.75	119.50 <sup>ab</sup>	313.75	123.25 <sup>ab</sup>	4.01 <sup>de</sup>	1.76 <sup>de</sup>	2.25 <sup>bc</sup>	0.78 <sup>b</sup>	0.075 <sup>a</sup>
<b>T6</b>	28.00	103.25 <sup>b</sup>	340.50	142.00 <sup>a</sup>	4.33 <sup>cd</sup>	1.98 <sup>cd</sup>	2.36 <sup>bc</sup>	0.85 <sup>ab</sup>	0.084 <sup>a</sup>
<b>T7</b>	31.50	109.00 <sup>ab</sup>	867.75	140.25 <sup>ab</sup>	4.17 <sup>cde</sup>	1.77 <sup>de</sup>	2.39 <sup>bc</sup>	0.75 <sup>b</sup>	0.059 <sup>b</sup>
<b>T8</b>	28.50	124.25 <sup>ab</sup>	342.25	113.50 <sup>b</sup>	4.66 <sup>bc</sup>	2.09 <sup>bc</sup>	2.57 <sup>bc</sup>	0.82 <sup>b</sup>	0.079 <sup>a</sup>
<b>T9</b>	31.75	100.50 <sup>b</sup>	321.00	123.25 <sup>ab</sup>	5.37 <sup>a</sup>	2.34 <sup>ab</sup>	3.03 <sup>a</sup>	0.78 <sup>b</sup>	0.085 <sup>a</sup>
<b>Overall mean± SE.</b>	29.64 ±1.46	114.22 ±2.82	391.17 ±61.98	127.39 ±2.98	4.43 ±0.01	1.99 ±0.05	2.44 ±0.06	0.83 ±0.02	0.072 ±0.00

a, b, c, d, e. Means with different superscript in the same column for the same item differ significantly (  $p < 0.05$ ).

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**Assessing characteristics of Online Education and comparing of Traditional Education**<sup>1</sup> Molouk Gharibpanah, <sup>2</sup> Azita Zamani<sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran

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**Abstract:** Distance education dictates changes in behavior for both the teacher and the learner. The successful student develops persistence and skills in self-directing work. The successful distance education teacher becomes conversant with new technology and develops new instructional styles, moving from creating instruction to managing resources and students and disseminating views. Administrative and faculty support for distance education are critical to the success of this instructional method. Administrators should take note that the implementation of a distance education program may allow access to a greater number of students. However, the time and work associated with teaching at a distance exceeds the normal requirements of campus-based instruction. Students in distance education settings perform as well or better on assignments, class activities, and exams when compared to campus-based students. Nevertheless, students must maintain persistence and a clear focus to succeed in a distance learning situation. Self-direction, a passion for learning, and strong individual responsibility are important influences on achievement. There are indications that distance education works best for more mature, motivated, well-organized, and already accomplished learners.

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**Keywords:** Online Education, Traditional Education

**Introduction:**

When the standardization and the requirements for training by the third millennium will be talking, unconscious form, design and construction to provide context and use tools and indicators to teaching the principles of community-based knowledge to the mind is centered. No doubt these requirements and identify the correct tools and proper utilization of their functions according to accelerate the development expected in the knowledge-based information society will be effective. Such concerns and problems that any country in its development plans in motion to the information becoming a knowledge based society means a society would be faced with the centrality of knowledge, Dealing with existing tools and how these tools are used.

Led the way when dealing with those massive training programs available to speak to the technological tools that we expect to occur that planners and decision makers that planners and decision makers of large structures, especially university education according to the image Access to the development of community information are available on these tools are selected and used. Massive wave of data produced in today's world it nicknamed the "information age" has all day and

through various means of communication in the world will move on its size are added. Other hand, as we're not the world witnessed the development of the role of information communication devices

transporting feedback fast and absorb the information around the world, we forget

Therefore, information and communication as the main lever or two important moves in developing wings, we learn. Meanwhile, proper utilization of the capacities of these two valuable and effective indexes in the general development concept for any society and the principles of a critical need is considered. With a view to clarifying this issue can be paid in the best way to create a platform for developing data standards and access to a knowledge based society, what really can be. To achieve a clear and practical answer in this area before all the existing definitions and indicators mentioned placed.

**What is Distance Education?**

Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is



completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-instructor relationship, which is the hallmark of distance education instruction. Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology. Courses are offered in gemology, high school diploma, journalism, locksmithing, child day care management, yacht design, and many fascinating subjects.

Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study. Since 1890, more than 130 million Americans have studied at DETC member institutions, including Franklin D. Roosevelt, Walter P. Chrysler, Walter Cronkite, Barry Goldwater, Charles Schulz, and many other distinguished alumni of DETC members.

Unlike most distance education courses offered by traditional colleges and universities that are semester and classroom oriented, with courses offered by most of the DETC-accredited institutions you can study any time and anywhere. Distance education is especially suited for busy people who wish to increase their knowledge and skills without giving up their jobs, leaving home, or losing income. You learn while you earn. Many courses provide complete vocational training; others prepare you for upgrading in your present job, without losing wages, experience or seniority. You receive individual attention, and you work at your own pace. In recent years, technology has played a significant role in transforming the traditional distance education school into a dynamic, interactive distance learning method using toll-free telephone lines, as well as a diverse array of personal computers, video devices, CD and DVD ROMs, online courses over the Internet, interactive devices, and other modern technological innovations. The future for distance study promises to be exciting!

### **Benefits of Distance Learning:**

Benefits and opportunities that distance education provides, include:

- training a wide range of audiences.
- meet the needs of students and students who can not attend in place.
- Possible connection between students and students with cultures, beliefs and experiences are different.
- Benefiting from coaches and speakers who do not live in the country.

### **Educational methods in distance learning:**

Today, under the new system replaced the traditional systems of learning and learning week (ie tutoring methods, lectures) are:

#### **- Multimedia courses:**

These courses and widely used elements of image, communication, graphics and simulated components, animation and communication elements for guidance and tips, and talk back on course and curriculum issues are held.

#### **- Enhanced communication mechanisms:**

The mechanism of any texts simultaneously, and asynchronous audio-visual communications to protect you. This case allows students to practice on topics learned will give.

#### **- Written test:**

thus, question and test via a distributed communication network, are corrected and returned. These exams through video conferencing support and runs.

#### **-Virtual Seminar:**

thereby different groups of students in different geographical environments linked together makes.

#### **- Collaborative virtual laboratories:**

the laboratory of the Group's activities are supported. Workshops such as software engineering.

#### **-Smart academic factors:**

academic factors that inform intelligent, support and guidance students pay.

### **Remote educational tool:**

distance learning tools and supplies various uses. These tools in four main courses are:

#### **A - Audio Tools:**

Audio tools include training such as two-way interactive telephone, video conference, shortwave radio and a strain of tools such as audio tape and radio.

#### **B - Image tools:**

including slides, films, video tapes and video conferences.

#### **C - Data:**

computers as electronic data are sent and received. Because the data word description for a wide range of educational tools is used.

Computer applications for distance education are varied and include the following:

- 1- Training to Computer Management.
- 2 - Computer Assisted Instruction.
- 3 - through PCs.
- 4 - e-mail, telegraph, computer conference and the World Wide Web simultaneously.

#### **D - Print:**

The main element of distance education programs, particularly in the exchange and delivery system information tools are considered.

### **Pros and Cons of Online Education**

Nowadays it is possible to do almost anything online. Many different types of diplomas, certifications, and academic degrees are available from online learning institutions.

This article discusses both the advantages and the disadvantages of online education. The Internet has enhanced and changed every aspect of our life, and now it is making inroads into the world of education. Online education and classes are not just a buzz; they are a new technology that is making a difference for teachers as well as students.

#### **Online Education Pros**

Of the many advantages and new possibilities of online education, here are some of the Strengths:

##### **1. Greater flexibility**

Online students have more freedom in choosing their programs and schedules. This allows many busy adults to adapt online courses to their already established everyday life of work and family. For many, this is simply the only way they can study for that degree which will take them farther in their career and life.

##### **2. Saves Time and Money**

Online education saves an enormous amount of time and money which in traditional education is wasted on commuting. Commuting is also very tiring, while online education means you can study from home, in a comfortable environment with everything you need

close at hand. Tuition also costs less for most online institutions.

### **3. Logistics**

Traditional education is restricted due to logistical issues; there is only this amount of students who can be in a place at a given time, whereas in online classes, there is no question of paucity of space. As long as the online classes have the necessary bandwidth, an unlimited number of students can study, all over the globe. Then again, traditional classes would turn up expensive to maintain, because the educational institution needs to maintain a place and its facilities. When it comes to online education, all they need to do is to set up E-learning tools, an Internet connection and a website where people can learn. While this is not cheap too, but it is definitely cost less as compared to the costs of a place to carry on.

#### **Online Education Cons:**

To balance our view of online education, let's consider some of the disadvantages/Weaknesses:

##### **1. Requires Self Discipline**

The greater freedom of online classes requires greater self disciplines, but not everybody has it. The comfort of studying from home may also reflect negatively on your motivation to do your best.

Depending on your personality, home can provide as many distractions as traditional campus facilities (designed especially for studying).

##### **2. How well have you learned**

With online education, the students have a greater hold on the education process, and that is not always a good sign. For example, in online education, though the teachers set up the audio and video clips with the same dedication, it remains to be seen whether the students study it with the same dedication that they would in a classroom.

##### **3. No Campus Life**

Many people remember the college/university as the best time of their lives. Part of it is the campus life – During and after classes. One of the disadvantages of taking online education rather than traditional one, is that in online education you will not have the atmosphere of

campus lawns, corridors and classrooms, huge libraries with real books you can hold. There will be no campus buddies and no campus culture.

#### 4. Internet Connection

Another negative point of online education is that it entirely depends on the internet connection. Though many countries have a robust Internet connection and others are getting it soon, there are still countries, and areas in countries that do not have access to Internet and other enhanced technologies. It would be difficult to get online education in countries that have a limited online presence.

These are just some of the distinguishing points between online classes and traditional classes.

### Online Education VS Traditional Education

This article reviews the differences and the pros and cons of online VS traditional education. Gone is the world where only traditional, campus-based education existed and you only had to choose the university or college you wanted to study in.

Someday, probably in the near future, Online Education will replace traditional institutions. At least, many degree programs will combine the on campus courses as well as online classes as a standard educational approach.

But for now, the future student has to decide first whether he/she wants to study online or on a campus degree.

Here are some points to consider the pros and cons of online and traditional institutions:

### Differences between Online and Traditional Education; Comparison

#### 1. Convenience

One of the most striking, innovative, and unprecedented features of online education is their convenience for almost anyone. Persons busy with careers or families will be able to compose their schedules so that they fit their individual time constraints. This is possible because courses are

delivered in the form of electronic-based modules online.

It is also convenient because it requires no commuting, saving a great deal of time and money. It allows to study from home, with the only requirement being the possession of an adequate computer and internet connection. Basic computer skills only are required to acquire higher education online.

#### 2. Expenses

Tuition costs less for most online institutions. Online education also eliminates the additional expenses usually entailed by traditional “campus life”, commuting, and the purchase of study materials.

#### 3. Feedback

Feedback is somewhat better in traditional education. Students can interact directly face to face with both classmates and teachers, which makes feedback easier to understand and faster to get. Some online institutions do offer chat rooms and video/audio meetings.

#### 4. Accreditation

The credit of online education depends on its purpose and context. If you only have online degree(s) and are just trying to find work, employers may prefer traditionally educated candidates. If you are already an employed and valuable professional, online learning will be seen favorable as a way to improve your skills, expand your professional knowledge, and thus contribute more at work.

#### 5. Ecology

Online education has obvious positive effect on the environment.

It may not be measurable now, but if online education largely replaces traditional institutions in the near future it will mean that less paper will be used for books and writing material and fewer campuses will be built while the number of students and employed teachers will only increase radically.

### Disadvantages of Online Education: Drawbacks to Consider

This article reviews the main disadvantages of the online education.

As online services in general are revolutionizing Internet activity and the business industry – Online Education is becoming increasingly popular.

It is not merely a new trend – for many people it is the only convenient way to acquire education. Online education already provides unique new opportunities which hadn't exist before.

The distance/online Education has not come to replace Traditional Education yet. The number of online universities and colleges is still relatively small and their services are not as well established as the services of traditional institutions.

### **Online Education – Disadvantages**

The following are its 4 main drawbacks one would want to consider -

#### **1. Human Interaction**

Online classes means there is not live, face-to-face classroom and office interaction between students and teachers. For many this is highly significant. Consulting lecturers in person and being able to discuss matters in groups, in and outside the class is, for many, an important motivational activity and learning strategy. Moreover, for many programs interpersonal communication is crucial, but it is not easy to seriously practice online. Many people also prefer traditional campus-based education simply for the on-campus atmosphere and the opportunity to meet many people there face-to-face between and during class, conferences, campus parties, concerts, fairs, and various cultural events.

#### **2. Study Materials**

Online institutions provide all or much of their material online, which may be convenient, since you have to buy and photocopy less. But while online information in general is, of course, extensive, approved and trusted scholarly academic material is not easily to be found online.

The resources of online universities and colleges are not yet as extensive as those of traditional institutions with their on-campus libraries (and the private libraries of generous lecturers who will always lend you that hard-to-find book you absolutely must have for your paper).

#### **3. No Lab Sessions**

Degrees science, especially the natural sciences, require lab hours. Online education as yet cannot provide a substitute for actual hands-on experience that students find in the labs on campus. Such experience is crucial in general, and it is often noted in particular by employees. One reason why graduates from traditional institutions are preferred is that they have extensive and relevant lab experience.

#### **4. Difficulties of Self-Discipline**

For many a significant advantage of traditional education is that it leaves little room for procrastination. You have to show up on campus and be in class, and for many this is a great motivational aspect and the reason for their eventual success. With online education the student has much more freedom. This can be both an advantage and a disadvantage. For many it is a disadvantage because it encourages procrastination. This leads either to unnecessarily prolonged studies or even failure to fulfill requirements, simply because there was too much freedom.

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**Assessing Different methods used in distance education**<sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi<sup>1,2</sup> Department of Agricultural Extension and Education, Varamin Branch, Islamic Azad University, Varamin, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** In the earlier days of distance learning, it was most common to see distance learning used for rural students who were at a distance from an educational institution. The student might watch a telecourse on a television stations, read texts, mail in assignments and then travel to the local college to take an exam. This model is still in use, but as the technology has become more sophisticated and the cost of distance learning dropped as equipment prices dropped, the use of distance education has increased. High front-end costs prevented an early widespread adoption of electronically mediated learning. Distance learning has been aggressively adopted in many areas because it can meet specific educational needs. As the concept of accountability became accepted and laws required certain courses in high school in order for students to be admitted to state colleges, telecommunications was examined as a way to provide student access to the required courses. Many rural school districts could not afford the special teachers to conduct required courses. Distance education met this need by providing courses in schools where teachers were not available or were too costly to provide for a few students. It also fulfilled a need for teacher training and staff development in locations where experts and resources were difficult to obtain. These systems link learner communities with each other and bring a wide array of experts and information to the classroom.

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**Keywords:** distance education, educational methods

**Introduction:**

enjoying and giving publicity to any of technological tools with the aim to facilitate and accelerate the training process, as well as increase the quality and quantity of knowledge quality and knowledge of a serious intelligence community needs to integrate and standardize the educational system society is.

Hence, considering the position and role of education in the third millennium on the basis of ICT is also a serious approach to the topic with the knowledge community centered on learning and general trends of technological tools to enjoy much of the information and Find the appropriate place in the information society Third Millennium That actually can be a global community and is without limit is undeniable-and-run. Guidance and therefore move in the direction of society should be education and technology for comprehensive pandemic done. Considering the above definitions and with the knowledge and attitudes towards the third millennium and the desirability and some weaknesses in the achievement of certain standards and dynamic structures in order to achieve a knowledge based society, there is. In the present circumstances to provide our information infrastructure development and integration inevitably link the elements and tools that they are as indicators of technology education

and technology education will be remembered. In the new context of combining these two indicators comes

to training facilities and a variety of tools that will provide guidance and development in information will be very effective.

While the effect of these two indices of body functions and its other fields (favorable to foster new ideas provides. Technologies training web-based technology as one of the most effective learning tools in educational issues have been identified and a total of E-learning as it is referred. . But if the scientific and cultural infrastructure with this technology's Day is not coordinated development of information will be obtained. This weakness caused by lack of growth and development of training required for pandemic knowledge of existing technology is. In many systems of scientific tools and capabilities needed to provide hardware and commissioning are still technological problems resulting from lack of knowledge of poverty and poor education in these centers to be seen.

In other words, the country still in the feasibility assessment and appropriate to make public the necessary training for operation and application of scientific principles and technological tools is has been done and why certain movements and sometimes non-normative point will not be able node an unlock.

The conditions and according to the capacity of developing countries and training facilities required a knowledge-based society feels is felt. If all processes in technology education and technology optimization

and standardization of the Hungarian education should go, and appropriate channels that the best option in this area could benefit from state universities is capabilities.

According to the information in the development of any society should take half of the world to progress until the necessary coordination and synchronization global developments so as to accept the design structure of a knowledge-based society have a special place for the University and respect the role of education and technology was In designing a model with global standards of dynamism and flexibility at first be necessary to select a sample that the facilities and communications needed for this purpose provide action and then determine optimal cognitive deficiencies than Hammett and weaknesses push.

No doubt the experiences of implementing these standards and to develop troubleshooting information using technological tools would be much more economical. That if we develop a range of information from a city university level and conduct more successful we'll be more acceptable was. Because the utilization and application tools and step up the information they've been successful. Therefore the most important first step needed to coordinate and synchronize technology education and educational technology standards and capability in the high user acceptability of the world is also enjoyed.

#### **Educational methods in distance learning:**

Today, under the new system replaced the traditional systems of learning and learning week (ie tutoring methods, lectures) are:

- **Multimedia courses:**

These courses and widely used elements of image, communication, graphics and simulated components, animation and communication elements for guidance and tips, and talk back on course and curriculum issues are held.

- **Enhanced communication mechanisms:**

The mechanism of any texts simultaneously, and asynchronous audio-visual communications to protect you. This case allows students to practice on topics learned will give.

- **Written test:**

thus, question and test via a distributed communication network, are corrected and returned. These exams through video conferencing support and runs.

- **Virtual Seminar:**

thereby different groups of students in different geographical environments linked together makes.

- **Collaborative virtual laboratories:**

the laboratory of the Group's activities are supported. Workshops such as software engineering.

- **Smart academic factors:**

academic factors that inform intelligent, support and guidance students pay.

#### **Key factors in the process of distance education:**

the process of remote training, the following factors contribute:

- **Students:**

Regardless of educational content, role and main element in the learning process students are responsible.

- **Coaches and Teachers:**

Success depends on a lot of educational activities the ability, skills and knowledge are the coaches and professors.

- **Facilitators of communication:**

Facilitator bases, as the bridge between students and mentors are. Must base expectations of teachers and educational needs of students and service coordination and communication to create.

- **Support staff:**

One of the important pillars of any development of distance education programs, by development group finds. Operational support staff such as student registration, copy and distribute their resources, order textbooks, security and copyright, and are responsible for the report.

- **Management:**

The group decision makers, builders and judges are considered to be educational and should be considered among the factors above, establish the correct relationship formation.

#### **What is Distance Education?**

Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-

instructor relationship, which is the hallmark of distance education instruction.

Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology. Courses are offered in gemology, high school diploma, journalism, locksmithing, child day care management, yacht design, and many fascinating subjects. Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study.

Since 1890, more than 130 million Americans have studied at DETC member institutions, including Franklin D. Roosevelt, Walter P. Chrysler, Walter Cronkite, Barry Goldwater, Charles Schulz, and many other distinguished alumni of DETC members. Unlike most distance education courses offered by traditional colleges and universities that are semester and classroom oriented, with courses offered by most of the DETC-accredited institutions you can study any time and anywhere. Distance education is especially suited for busy people who wish to increase their knowledge and skills without giving up their jobs, leaving home, or losing income. You learn while you earn. Many courses provide complete vocational training; others prepare you for upgrading in your present job, without losing wages, experience or seniority. You receive individual attention, and you work at your own pace.

In recent years, technology has played a significant role in transforming the traditional distance education school into a dynamic, interactive distance learning method using toll-free telephone lines, as well as a diverse array of personal computers, video devices, CD and DVD ROMs, online courses over the Internet, interactive devices, and other modern technological innovations. The future for distance study promises to be exciting.

## FORMS OF DISTANCE EDUCATION

In its original form, teachers using distance education traveled to remote sites and taught a class, or corresponded with students through mail, telephone,

or fax machine. Individualized study has been a method of reaching the remote student for some time. Detailed course instructions are sent to the learner who performs the assigned tasks and returns the completed work to the teacher for evaluation and reassignment if necessary.

Technology has raised the quality of individualized distance instruction. The use of various forms of electronic media increases time effectiveness and improves the delivery of information. Video, audio, and computer-based applications may enhance the product received by the independent learner. Electronic delivery can occur using synchronous communication, in which class members participate at the same time, or asynchronous communication where participants are separated by time (Romiszowski, 1993).

Video/audio models of distance education include broadcast television, cable television, satellite, microwave, fiber optics, and audio graphics. The most widely used format is broadcast and cable television (Parrott, 1995). However, developments in satellite and fiber optic systems have produced other successful programs. The interactive capability of many of these networks has produced a distance classroom that is nearly identical to a regular classroom. Teachers and students can interact through both two-way video and one-way video with two-way audio systems. The recent development of Desktop Video Conferencing (DVC) which brings interactive video capability to the desktop computer, further enhances learning opportunities.

The linking of computer technology through the use of the Internet or CD-ROM with television transmission provides a potentially new dimension to distance education. This technique can link university professors to high school teachers, or to physically disabled students, in a distance setting (McLean, 1996).

Another form of interaction is the use of computer conferencing. This method utilizes asynchronous communication in such forms as an e-mail list group, an Internet discussion group, or other types of conferencing software. Asynchronous methods of communication are especially appealing to the learner who has difficulty scheduling specific time- and place-bound course work.

## Conclusion:

Distance learning is expanding and examples of it are increasing dramatically. Fewer than 10 states were using distance learning in 1987; today, virtually all states have an interest or effort in distance education. Distance learning systems connect the teacher with the students when physical face-to-face interaction is not possible. Telecommunications systems carry instruction, moving information instead of people. The technology at distant locations are important and affect how interaction takes place, what information resources are used, and how effective the system is likely to be.

Technology transports information, not people. Distances between teachers and students are bridged with an array of familiar technology as well as new information age equipment. What sets today's distance education efforts apart from previous efforts is the possibility of an interactive capacity that provides learner and teacher with needed feedback, including the opportunity to dialogue, clarify, or assess. Advances in digital compression technology may greatly expand the number of channels that can be sent over any transmission medium, doubling or even tripling channel capacity. Technologies for learning at a distance are also enlarging our definition of how students learn, where they learn, and who teaches them. No one technology is best for all situations and applications. Different technologies have different capabilities and limitations, and effective implementation will depend on matching technological capabilities to education needs.

Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home.

The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems

are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.

Interactivity is accomplished via telephone (one-way video and two-way audio), two-way video or graphics interactivity, two-way computer hookups, two-way audio. Interactivity may be delayed but interaction provided by teacher telephone office hours when students can call or through time with on-site facilitators. Classes with large numbers of students have a limited amount of interactivity. Much of the activity on computer networks is on a delayed basis as well. Possibilities for audio and visual interaction are increasingly wide.

In the earlier days of distance learning, it was most common to see distance learning used for rural students who were at a distance from an educational institution. The student might watch a telecourse on a television stations, read texts, mail in assignments and then travel to the local college to take an exam. This model is still in use, but as the technology has become more sophisticated and the cost of distance learning dropped as equipment prices dropped, the use of distance education has increased.

High front-end costs prevented an early widespread adoption of electronically mediated learning. Distance learning has been aggressively adopted in many areas because it can meet specific educational needs. As the concept of accountability became accepted and laws required certain courses in high school in order for students to be admitted to state colleges, telecommunications was examined as a way to provide student access to the required courses. Many rural school districts could not afford the special teachers to conduct required courses. Distance education met this need by providing courses in schools where teachers were not available or were too costly to provide for a few students. It also fulfilled a need for teacher training and staff development in locations where experts and resources were difficult to obtain. These systems link learner communities with each other and bring a wide array of experts and information to the classroom.

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**Characterization of Online Degrees and comparing with Traditional Degrees**<sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh<sup>1,2</sup> Department of Agricultural Extension and Education, Varamin Branch, Islamic Azad University, Varamin, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** Technology transports information, not people. Distances between teachers and students are bridged with an array of familiar technology as well as new information age equipment. What sets today's distance education efforts apart from previous efforts is the possibility of an interactive capacity that provides learner and teacher with needed feedback, including the opportunity to dialogue, clarify, or assess. Advances in digital compression technology may greatly expand the number of channels that can be sent over any transmission medium, doubling or even tripling channel capacity. Technologies for learning at a distance are also enlarging our definition of how students learn, where they learn, and who teaches them. No one technology is best for all situations and applications. Different technologies have different capabilities and limitations, and effective implementation will depend on matching technological capabilities to education needs.

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**Keywords:** Online Degrees and, Traditional Degrees, distance education

**Introduction:**

enjoying and giving publicity to any of technological tools with the aim to facilitate and accelerate the training process, as well as increase the quality and quantity of knowledge quality and knowledge of a serious intelligence community needs to integrate and standardize the educational system society is.

Hence, considering the position and role of education in the third millennium on the basis of ICT is also a serious approach to the topic with the knowledge community centered on learning and general trends of technological tools to enjoy much of the information and Find the appropriate place in the information society Third Millennium That actually can be a global community and is without limit is undeniable-and-run. Guidance and therefore move in the direction of society should be education and technology for comprehensive pandemic done. Considering the above definitions and with the knowledge and attitudes towards the third millennium and the desirability and some weaknesses in the achievement of certain standards and dynamic structures in order to achieve a knowledge based society, there is. In the present circumstances to provide our information infrastructure development and integration inevitably link the elements and tools that they are as indicators of technology education and technology education will be remembered. In the new context of combining these two indicators comes to training facilities and a variety of tools that will provide guidance and development in information will be very effective.

While the effect of these two indices of body functions and its other fields (favorable to foster new ideas provides. Technologies training web-based technology as one of the most effective learning tools in educational issues have been identified and a total of E-learning as it is referred. . But if the scientific and cultural infrastructure with this technology's Day is not coordinated development of information will be

obtained. This weakness caused by lack of growth and development of training required for pandemic knowledge of existing technology is. In many systems of scientific tools and capabilities needed to provide hardware and commissioning are still technological problems resulting from lack of knowledge of poverty and poor education in these centers to be seen.

In other words, the country still in the feasibility assessment and appropriate to make public the necessary training for operation and application of scientific principles and technological tools is has been done and why certain movements and sometimes non-normative point will not be able node an unlock.

The conditions and according to the capacity of developing countries and training facilities required a knowledge-based society feels is felt. If all processes in technology education and technology optimization and standardization of the Hungarian education should go, and appropriate channels that the best option in this area could benefit from state universities is capabilities.

According to the information in the development of any society should take half of the world to progress until the necessary coordination and synchronization global developments so as to accept the design structure of a knowledge-based society have a special place for the University and respect the role of education and technology was In designing a model with global standards of dynamism and flexibility at first be necessary to select a sample that the facilities and communications needed for this purpose provide action and then determine optimal cognitive deficiencies than Hammett and weaknesses push.

No doubt the experiences of implementing these standards and to develop troubleshooting information using technological tools would be much more economical. That if we develop a range of information from a city university level and conduct more successful we'll be more acceptable was. Because the utilization

and application tools and step up the information they've been successful. Therefore the most important first step needed to coordinate and synchronize technology education and educational technology standards and capability in the high user acceptability of the world is also enjoyed.

## WHAT IS DISTANCE EDUCATION?

Distance education is a method of education in which the learner is physically separated from the teacher and the institution sponsoring the instruction. It may be used on its own, or in conjunction with other forms of education, including face-to-face instruction. In any distance education process there must be a teacher, one or more students, and a course or curriculum that the teacher is capable of teaching and the student is trying to learn. The contract between teacher and learner, whether in a traditional classroom or distance education, requires that the student be taught, assessed, given guidance and, where appropriate, prepared for examinations that may or may not be conducted by the institution. This must be accomplished by two-way communication. Learning may be undertaken either individually or in groups; in either case, it is accomplished in the physical absence of the teacher in distance education. Where distance teaching materials are provided to learners, they are structured in ways that facilitate learning at a distance.

## Online Degrees Vs Traditional Degrees

It's best to consider the pros and cons for online and traditional education, before choosing either one. This is because, today, one really needs to choose between the two, since online education is an increasingly powerful presence in the field. It is becoming more and more relevant, with its new and unprecedented features, connecting people globally at the click of a mouse.

Let us discuss the differences between these two options – Comparing the traditional degree programs to the new online degree programs.

## What are the Pros of Online Degree Programs?

Four main advantages:

### 1. Flexibility

Traditional education means predetermined schedules and the ability to attend classes only during the day. Online institutions provide classes in the form of online modules and allow students to schedule them for

whenever they will. This makes it possible for people to combine full time work and family life with higher education.

## 2. Academic Material

Online institutions eliminate the need to buy textbooks (unless you want to). Most or all of the material is readily available online, in the form of Web-pages and e-Books. There are extensive academic research archives online, used by both online and offline institutions.

## 3. Time to Degree

Online degrees allow anyone to reduce time to get the degree – To compress what is traditionally a four year degree into as little as a year or two.

## 4. New Skills

For professionals who are employed full time but who wish to enhance their knowledge, learn new skills, add intellectual variety or challenge to their life, or even to change their career entirely by studying a new profession – online education provides unprecedented opportunities.

Attending traditional classes may be impossible for full-time employees. Quitting the job may not be an option. Online education provides the solution: flexible schedules (see above) which allow adjusting study time and working time even for the busiest of businessmen.

## The Cons of Online Degree Programs

Here are the main shortcomings:

### 1. Credits and Accreditation

Remember that not all online institutions are accredited or have the required accreditation. Some online degree credits are transferable and some are not – It is important to find the level of accreditation that the online institution provides – Regionally or nationally accreditation. There are however, those online institutions which are considered to be on the par with established traditional education systems.

### 2. Suitability

It's best not to idealize online programs and what they offer. Studying from home may sound great, but not everyone

has the right environment at home for academic study. For some people, specially designed campuses are ideal to get away from the distractions of the home and to immerse yourself in study.

### 3. No face-to-face human interaction

Online degree programs and online courses have their advantages, but they lack human interaction. These prevent the normal interactions between students and teachers, relegating any queries to the message boards and forums.

Only video interaction may be possible with online degree programs and its exact use and frequency vary from institution to institution, while the actual classes are given via archived modules. For those who prefer human interaction, online degree program may not be the best option.

### 4. Independent study isn't good for all

Online degree study may require better comprehensive skills than traditional education. In traditional classroom environment, it may be easier to understand instructional material because of the human proximity and the option to ask questions and get immediate sympathetic answers.

### Are Online Degrees Worth Anything? Are Online Degrees Credible?

Many people consider online degrees as not worthwhile proposition.

They think online degrees are a waste of time and money; further, they feel such degrees are not recognized anywhere.

### So, are online degree programs worth anything?

Well, it is quite natural to have apprehensions about something that you do not know about. In fact, when online courses were newly launched, they were widely unaccepted by many corporations and campus based educational institutions. However, the situation has now changed.

Online degrees are gaining popularity. Further, such degrees are being offered and widely accepted. As per a recent survey conducted by Distance Education and Training Council, more than 71% of corporations consider online degrees as 'more valuable' and worthwhile than the traditional one.

How can one understand the value of an online degree?

Though, surveys mark online degrees with certain amount of credibility, how does one make sure the value attached?

### Online Degree Program: Should you go for it?

The first question asked is –

### Is an online degree worth anything? What is the real Value of online degrees?

Check for the accreditation! The accreditation attached to the online degree is the key here. As for any campus based degree program, there are accredited online degrees and non accredited online degrees based on the online school accreditation. Therefore, the accreditation of the online educational institution must be checked carefully.

For more information, refer to Online Schools Accreditation Meaning. Let us acquaint ourselves with the merits and demerits on online degrees for understanding the value attached.

### Merits of online degrees:

**1. Ease of Access:** The course material and instructions can be accessed by a student from anywhere across the globe. This can be done via an internet connection. This provides greater freedom to students and working professionals to study the course material.

**2. Genuine interactivity:** Online courses provide students with a high level of interactivity. How? Since the students are far apart geographically, they have more time to ponder over the facts and get back with logical reasoning and viewpoint. This is not so in case of traditional classes.

**3. Dissemination of information:** Online courses have the advantage of reaching out to larger masses as compared to traditional studies. Further, additions and amendments can easily and more quickly be disseminated to students.

**4. Documentation:** The best part of online courses is every material, discussion, presentation and interaction is electronically documented. Thus, a student can refer to such documents anytime, anywhere.

Perhaps, the only demerit of online degree is the kind of infrastructure it requires. An online course requires a sound IT infrastructure that can support the smooth functioning of online class rooms.

### **Earn a Degree Online: Why Get a Degree Online?**

These days, one can get a degree without going to college. Online education is the latest concept that has taken the world of education by storm.

Though online education is still in its initial stages in many parts of the world, it becomes a great option, particularly in the western world, and has certain advantages over traditional education, which makes it so popular.

Online education is not just advantageous to the teachers, but has its advantages for the students too. While teachers can make decent money by teaching online, students can also get online degrees in a simple manner.

This article addresses the first questions asked about online degrees – Why Earn an Online Degree?

### **Earn Your Degree Online: Should You Get An Online Degree?**

There are several reasons why a person would opt for an online degree.

Let us address these key initial queries -

1. Why do you need a degree?
2. Why Online Degree program and not traditional one
3. Are online degrees worth the same as traditional degrees?
4. What are the choices for an online degree?
5. Time to Degree – The time it takes to earn a degree

### **Why get a degree online?**

The first question asked naturally is – Why an Online degree and not the traditional degree?

Both ways are good as long as you look for an accredited online degree.

An online degree is absolutely not less Qualitative – There is no difference between the value of a traditional degree and an online degree given that – You will check very carefully the accreditation of the online educational institution before taking a degree program online.

If you are wondering whether you should get an online degree, you would be surprised to know that many people have no other choice but to opt for an online degree.

There are several reasons why one needs to get an online degree, but the most common are:

- In many cases, people need extra degrees to pursue a career in a profession that they are interested in.
- Many people do not continue their education for a number of reasons, and by the time they are ready to pursue their education, they are working or even have a family. An online education makes life simpler for people like them.

### **Why take Online Degree program?**

Consider the pros and cons for online education and traditional education, before choosing either one.

### **Online degree choices – What are the choices?**

Online education provides almost the entire scope of education, starting from an Associate degree up to PhD degree online. There are streams of education, and even some professional specialized courses. For example:

- You can complete your school or college education via the online universities.
- You can also get other, professional degrees online such as, a degree for managers a MBA, Master of Business Administration online.
- Professional course, online learning – You can complete computer courses online and get a certificate, a diploma. These courses are best fit for people who want to advance their professionalism with a specific online degree of their industry for getting a lift up off their career.

Therefore, if you are thinking how to get a degree at home, you would first need to decide which degree is of your interest – Which degree you want to get.



### How long does it take to earn an online degree? Time to Degree

If you are wondering how long it takes to get a degree online, the answer would basically depend on what kind of education you are planning for.

Although the stigma of the Online Education as the fastest way to get a degree, it isn't necessarily true – It depends on the kind, type and value of the online degree you are looking for.

For example,

- If you want to opt for a business degree, you would need to study for two or three years.
- If you wish to go in for any professional software degree online, you would need a study time of several months.

It all depends on what kind of an online degree program you are going in for, as well as the degree level you wish to achieve.

### Conclusion:

In general, new methods of educational systems to countries around the world as a necessity and need for learning and training opportunities to study in areas with different climatic features and conditions of learning and education according to their gender and cultures, has been. Each method is mentioned with regard to changes in features and creates an education system, and evaluation is used. Judgement of distance education in an educational way, first as a necessity to eliminate barriers to educational climate and geographical areas, age and gender restrictions learners began their work And more in a death education system, especially in the philosophy and goals based on theories of learning theories have evolved to find and promote professional growth. Approach to distance education with regard to the necessity of education in countries formed.

Emergence and development of information societies is the consequences of industrialization. Despite the diversity of information in various forms of media in local, national and international, access, exchange and use of various information easier than last time is. Information society, a member of your buddies know that open information system in terms of geographical location and the last 25 years, organizational development, are limited. Distance learning faster than other forms of training has been.

Growth factor in the economic interests of this type of educational approach, flexibility and remove the distance can be named. The methods of distance

education, required for building physical education is not providing services. Teachers and trainers in this method - compared with traditional methods - and have more opportunities to more people than are being trained. In this type of teaching style of each person in each academic field, and each job can be arbitrary in time and space, trained without having to leave the house for work or business is education. This method requires that students are dispersed over long distances provides. Distance learning advantages of distance education in comparison with traditional education, the need for physical locations and training programs limited to no specific time period. In this type of teaching style, learning for life without possibility of spatial and temporal constraints for each individual there. In distance education, problems related to lack of qualified teachers and appropriate educational environment - as it posed in the traditional method of M is - is resolved. In this way the use of advanced features in digital libraries and search the various sites during the study, time and cost savings are.

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## Effects of black tea in mitigation of sodium fluoride potency to suppress motor activity and coordination in laboratory rats

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**Abstract:** The present study was designed to assess the potential impact of Na-F alone or in conjugation with black tea on motor function and coordination performance in laboratory rats. An array of behavioural motor tasks, viz., open field, plank walking and rod walking tests were employed in our study in order to evaluate animals' motor health. Body weight gain as a performance criterion was also monitored. Eighty weanling 32-days old Wistar male rats randomly allotted to four groups of 20 animals each, were administered Na-F at 100 ppm and 2% black tea for a period of twelve weeks in a factorial pattern to constitute 4 experimental treatments. Black tea significantly improved Na-F-induced marked losses in body weight gains of rats. In the open field test, Na-F-treated rats displayed no significant changes in the levels of motor activities (horizontal locomotion) compared to control. However, fluorotic animals performed poorly in all studied motor-coordination tests. Administration of black tea to Na-F-exposed rats also significantly enhanced their motor performance and coordination ability during psychomotor testing. Concerning animals' walking pattern, high incidence of shaky movements with unsteady gait was markedly observed in Na-F-intoxicated rats, as compared to control, confirms lacking of muscle tone and coordination. Our findings illustrate that black tea affords a profound protection against fluoride intoxication-provoked harmful effects on motor health as signified by inhibited motor activities accompanied by poor coordination proficiency in laboratory rats, and hearten to recommend for simultaneous supplementation of black tea to Na-F-jeopardized individuals in order to help mitigate fluorosis-inflicted hazards.

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**Keywords:** Sodium fluoride, skeletal fluorosis, black tea, motor activity, coordination, psychomotor testing, body weight gain

### 1. Introduction

Fluoride is omnipresent in our environment and has been added to drinking water supplies for cariostatic purposes as a prophylactic agent in dental caries, with a recommended dose between 0.7 and 1.2 mg/litre (Leverett et al., 1997). Further fluoride sources, other than drinkable water, are drinks, tooth pastes, mouth rinses, dietary supplements and foods in general.

Fluorosis caused by excess intake of fluoride is a slow, progressive degenerative disorder that represents a significant adverse impact on public health and well-being in many parts of the world (Susheela, 1999). Long term ingestion of high levels of fluoride results in various pathological alterations in overall organs and tissues predominantly the bones, teeth, the structure and function of skeletal muscles, brain and spinal cord (Shashi et al., 1992; 1994; Mullenix et al., 1995; Vani and Reddy, 2000).

More than 90% of the total body burden of fluoride is retained in bones and teeth, because of its profound affinity for calcified tissues, where most of the remaining portion is distributed in highly vascularized soft tissues and blood (Hardman et al.,

2005; Fawell et al., 2006). Therefore, the most obvious early toxic effects of fluoride in humans are skeletal fluorosis, leading to a variable degree of combined locomotor disability and neurological impairment (Reddy, 2009). Individuals affected with skeletal fluorosis revealed joints pain in limbs, numbing, cramping and tingling of extremities accompanied with back pain with difficulties during walking, aggravated by activity (Shashi et al., 2008). Since animal studies and human clinical trials indicated that fluoride can reduce bone strength even before skeletal fluorosis is present, a heavy and tired feeling in the legs with frequent falling, or "a foot-slapping gait" is also a commonly noticeable manifestation (Mousny et al., 2006).

In advanced stages, "crippling skeletal fluorosis" characterized by damage of musculoskeletal and nervous systems is then observed. The later disorder results in mal shaping of bones, muscles wasting and arthritic pain with restricted joints motion. Neurological complications of skeletal fluorosis, namely paralysis of limbs, vertigo, spasticity in extremities, arise primarily from mechanical compression of the spinal cord and nerve

roots from sclerosed vertebral column and ossified ligaments (Fisher et al., 1989; Reddy, 2009). Alarm was then given about an increased fluoride toxicity-inflicted risk on physical activity and motor health.

In addition to the effect on hard tissues, fluoride also manifests its toxicity on soft tissues, where it is known to cross the cell membranes and to enter soft tissues, impairing its function (Sharma and Chinoy, 1998; Vani and Reddy, 2000). Fluoride-increased generation of free radicals, lipid peroxidation and depleted antioxidant defense systems shifting the oxidant/antioxidant balance towards oxidative stress are proposed to mediate the toxic effects of fluoride on soft tissues (Shivarajashankara et al., 2001; 2002a; Trivedi et al., 2008; Kaur et al., 2009).

Amongst soft tissues, muscles and brain have been reported to retain the ingested fluoride which may in turn interfere with their physiological functions. Despite the fact that muscles were more affected than brain, probably due to the protective role of the blood brain barrier, there is a paucity of studies on the effect of fluoride intoxication on motor function and coordination performance in rats (Vani and Reddy, 2000).

Intact cerebellum has been reported primarily to be indispensable for successful coordination of voluntary motor function and to make an important contribution to control of muscle tone, equilibrium, gait and posture (Morton and Bastian, 2004; Thach and Bastian, 2004; Konarski et al., 2005; Koros et al., 2007; Baldacara et al., 2008). Cerebellar cortex has been evidenced to be particularly susceptible to sodium fluoride-induced oxidative stress and could contribute to the development of neurodegenerative diseases (Saad El-Dien et al., 2010). Moreover, recent findings from our preceding complementary study, where fluoride toxicity-enhanced oxidative stress and induced neurodegenerative lesions in the cerebellum of rats, have prompted us to further investigate the toxic potential of fluoride to disrupt motor-coordination function as an index for the health of musculo-skeletal system (Kamel et al., 2010).

On the positive side, however, the link between fluoride and oxidative stress may help efforts to mitigate the symptoms among individuals suffering from fluoride toxicity. Therefore, nutritional intervention with antioxidant-rich substances is the ultimate goal as antidotes for combating with the health complaints arising from fluorosis (Chinoy and Memon, 2001; Chinoy and Patel, 2001; Susheela and Bhatnagar, 2002).

Most of the health benefits of different types of tea are attributed to their antioxidant content where it is rich in polyphenolic compounds, collectively

known as the tea flavonoids (du Toit et al., 2001). Tea flavonoids are known to exhibit antioxidative property being comparable to that of fruits and vegetables, thus the high, yet varying levels of antioxidants in teas might mitigate the deleterious toxic effects of fluoride.

Tea is most commonly consumed in its black form (Das et al., 2005). Since the fermentation process used to make black tea converts the green tea catechins into other compounds, theaflavins and thearubingins, it has been assumed that the health benefits of black tea are lesser than that of green one. However, recent studies indicate otherwise, where the latter compounds provide the health benefits of black tea which were originally attributed solely to green tea (Leung et al., 2001; Unno and Hoshino, 2007).

Our earlier experiment revealed a profound neuroprotective effect of black tea against Na-F-induced deleterious effects in brain tissues of rats, namely in the hippocampus and cerebellum, as reflected by learning deficits and confirmed by detrimental pathological lesions (Kamel et al., 2010). In view of this, the present study was considered necessary in order to further explore the toxic potency of fluoride intoxication to impair motor-coordination abilities and also to evaluate the possible role of black tea to counteract these predictable negative impact triggered by Na-F in laboratory rats. In addition, rats' body performance in the form of weight gains was also explored in the current study.

## **2. Material and Methods**

### **2.1. Animals and housing:**

Animal experimentation was performed in accordance with guidelines released by Cairo University Policy on Animal Care and Use, with the International regulations, as adopted and promulgated by Faculty of Veterinary Medicine. According to the above guidelines, all efforts were made to minimize the number of animals and their suffering.

Eighty weanling 32-days old Wistar male rats, weighing approximately 45g were obtained from the Unit for Laboratory Animals at Faculty of Veterinary Medicine, Cairo University and used in our study. They were housed in standard polypropylene cages with stainless steel wire lids, bedded with wood shavings. Animals were maintained on a 12-h light/dark cycle at a constant room temperature of 20-22°C and 60% humidity with free access to feed (standard commercially available pellets for laboratory rodents) and water throughout the course of the present study.

### **2.2. Experimental design:**

All males were randomly distributed into four groups having 20 animals each, divided on 2 replicates. The route chosen in this study for exposure was via drinking water to mimic human exposure. Animals were administered our treatments, throughout the study till its completion at 115 days of age, in a 2 x 2 factorial design as follows:

Group (1) control (C), n=20: Weanling pups were administered plain water.

Group (2) Na-F group (F), n=20: Weanling pups were exposed to *ad libitum* supply of Na-F alone (Sigma Chemical Company) in drinking distilled water at 100 ppm on a mg/kg/day basis of 10.77 Na-F (Chioca et al., 2008).

Group (3) black tea group (T), n=20: Weanling pups were exposed to *ad libitum* supply of 2% black tea alone in drinking water (Trivedi et al., 2006). Twenty grams of black tea solids (Lipton Yellow label, Unilever Limited, India) and 1000 ml boiled drinking water were used to produce a 2% tea solution.

Group (4) ameliorated group (Na-F+T), n=20: Weanling pups were exposed to *ad libitum* supply of 100 ppm Na-F in combination with 2% black tea solution.

### 2.3. General observations in rats:

During experimental period, clinical signs and general appearances that included awareness, motor activity, and posture were checked daily.

### 2.4. Body weight gain:

Initial weight of all pups were recorded on postnatal day 32, and then all rats per group were individually weighed weekly afterwards throughout the study up to 115 days of age. Body weight gain was calculated as the difference between final and baseline weight. Mortalities were recorded as it occurred.

### 2.5. Behavioural tests:

All behavioural testing were conducted by the same personnel throughout the study, started at 90 days and ended at 115 days of animals' age.

#### 2.5.1. Open field test

The open-field exposure is commonly used as a measurement of locomotor activity and can also serve as good preliminary test to determine motor deficits (Kelly, 1993; Chioca et al., 2008). The test was performed in a square wooden arena measured (90 x 90 x 25 cm). The wood of the apparatus is covered with a plastic laminate (formica), which prevents absorption of fluids (urine of rats). The floor was divided by black lines into 36 small squares (15 x 15 cm). All testing was conducted between 09:00 and 15:00 h. All treatment groups were tested at the same day in a random array. Rats were gently placed

into a corner of the arena and allowed to explore it freely for 3 minutes.

Levels of animals' locomotory activity were determined by measuring changes in ambulation (horizontal locomotion). Ambulation is assessed in relation to lines drawn on the floor (the number of squares crossed). A crossed square was defined as the rat placing its two forepaws in the next square and moving forward (Chioca et al., 2008). The number of units crossed in the open field was used as a primary index of locomotor activity. Hand operated counters and stop watches were used to score the behaviour of animals.

After the 3 minutes test session, the rat was returned to its home cage and the open field was cleaned with 70% ethyl alcohol, to remove olfactory cues and permitted to dry between tests.

#### 2.5.2. Psychomotor testing

Animals of the four treatments were examined with two different motor tests; plank walking and rod walking. All tests were conducted between 09:00 and 11:00 h for all treatment groups and only once on each animal.

##### 2.5.2.1. Plank walking:

Balance and coordination were measured by exposing the rats to one trial on each of two horizontal planks (narrow = 1.5 cm and wide = 4.0 cm), each of 100 cm long and placed 34 cm high above a table-top. Distances traveled as well as number of turns on the planks were recorded (Shukitt-Hale et al., 1998).

##### 2.5.2.2. Rod walking:

The ability of rats to balance on a stationary horizontal rod measures psychomotor coordination. Animals were placed in the center of a rod (100 cm long, 2.6 cm in diameter and positioned 23 cm high above a table-top), parallel to it, and their latency to fall off the rod onto a cushion placed below, with a time ceiling of 60 s, was recorded (Shukitt-Hale et al., 1998).

### 2.6. Statistical analysis

Statistical analysis was performed on all parameters by means of analyses of variance (ANOVA) to judge the influence of supplementation of Na-F and black tea to rats using the general linear models procedure in SPSS<sup>®</sup> statistical software (SPSS, 2006). After confirmation of significant effects in the overall ANOVA, data for different treatment groups was compared using post hoc Tukey HSD test. For all tests, significance was set at  $p < 0.05$ . Data are presented as mean  $\pm$  SEM.

## 3. Results



### 3.1. Body weight gain:

As seen in Table 1, oral administration of Na-F as compared with control group caused a their counterparts in control group. Nevertheless, the intensity of diminution in gains was significantly different between animals in Na-F and those in T group. Moreover, administration of black tea along with Na-F significantly improved Na-F-induced losses in weight gains. Comparable averages of gains were recorded in the ameliorated and tea groups.

### 3.2. Open field test:

There were no significant differences in horizontal activity (numbers of line crossings) between the animals treated and control group as shown in table 2.

### 3.3. Psychomotor testing:

Performance in psychomotor tests was demonstrated in Table 3. In the plank walking test, total distance traveled on the narrow plank as well as numbers of turns were significantly lower in Na-F-

significant reduction in body weight gains ( $F_{(1, 36)} = 18.56$ ;  $p = 0.00$ ). Likewise, rats administered black tea solution alone showed lowered weight gains than treated rats compared to control rats ( $F_{(1, 36)} = 11.27$ ;  $p = 0.00$ ) and ( $F_{(1, 36)} = 13.94$ ;  $p = 0.00$ ), respectively. For the wide plank walk, rats administered Na-F showed no improvement, where their measurements were still significantly lower compared to counterparts administered no Na-F ( $F_{(1, 36)} = 8.31$ ;  $p = 0.01$ ) and ( $F_{(1, 36)} = 46.25$ ;  $p = 0.00$ ), respectively. Administration of black tea solution to Na-F-treated rats significantly improved performance in the motor task to a similar level observed in the control and tea groups.

On the rod walk, less latencies to fall were significantly detected in Na-F group compared to all other treatments ( $F_{(1, 36)} = 28.60$ ;  $p = 0.00$ ). Black tea significantly extended time required to fall when administered to Na-F-exposed rats, to the extent shown in the control and tea groups.

**Table 1. Effect of Na-F and its amelioration by black tea on body weight gain (BWG) of rats.**

	(C) Group	Experimental Groups (Na-F) Group	(T) Group	(Na-F+T) Group
<b>BWG (g)</b>				
Day 32-115	180±4.36 <sup>a</sup>	91.6±3.82 <sup>b</sup>	137.4±3.41 <sup>c</sup>	134.2±3.09 <sup>c</sup>
Day 32-115 (change from control%)	0	-49.11	-23.67	-25.44

(C) Group: Animals received plain water without any treatment and served as a control.

(Na-F) Group: Animals received 100 ppm Na-F.

(Na-F+T) Group: Animals received 100 ppm Na-F + 2% black tea solution.

(T) Group: Animals received 2% black tea solution alone.

<sup>a-c</sup>Values within row with unlike superscripts differ significantly ( $p < 0.05$ ), according to ANOVA. Values represent mean±SEM of 10 animals per treatment.

**Table 2. Effect of Na-F and its amelioration by black tea on locomotor activities in open field test in rats.**

	(C) Group	Experimental Groups (Na-F) Group	(T) Group	(Na-F+T) Group
<b>Ambulation (Horizontal locomotion)</b>	50.3±3.93 <sup>a</sup>	55.8±1.26 <sup>a</sup>	46.9±4.44 <sup>a</sup>	51.8±3.14 <sup>a</sup>

(C) Group: Animals received plain water without any treatment and served as a control.

(Na-F) Group: Animals received 100 ppm Na-F.

(Na-F+T) Group: Animals received 100 ppm Na-F + 2% black tea solution.

(T) Group: Animals received 2% black tea solution alone.

<sup>a-c</sup>Values within row with unlike superscripts differ significantly ( $p < 0.05$ ), according to ANOVA. Values represent mean±SEM of 10 animals per treatment.

**Table 3. Effect of Na-F and its amelioration by black tea on performance in psychomotor tests in rats.**

	Experimental Groups			
	(C) Group	(Na-F) Group	(T) Group	(Na-F+T) Group
<b>1) Plank walking:</b>				
<b>a. Narrow plank</b>				
Distance traveled (cm)	64.00±3.79 <sup>a</sup>	33.00±5.49 <sup>b</sup>	67.50±8.93 <sup>a</sup>	57.50±5.02 <sup>a</sup>
No. of turns	2.40±0.27 <sup>a</sup>	0.60±0.22 <sup>b</sup>	2.60±0.50 <sup>a</sup>	2.00±0.21 <sup>a</sup>
<b>b. Wide plank</b>				
Distance traveled (cm)	102.50±17.67 <sup>a</sup>	37.00±6.88 <sup>b</sup>	125.00±19.99 <sup>a</sup>	99.00±15.80 <sup>a</sup>
No. of turns	3.50±0.17 <sup>a</sup>	1.10±0.18 <sup>b</sup>	3.60±0.22 <sup>a</sup>	2.90±0.31 <sup>a</sup>
<b>2) Rod walking:</b>				
Latency to fall (s)	40.40±2.74 <sup>a</sup>	14.80±1.36 <sup>b</sup>	45.80±4.34 <sup>a</sup>	32.80±4.90 <sup>a</sup>

(C) Group: Animals received plain water without any treatment and served as a control.

(Na-F) Group: Animals received 100 ppm Na-F.

(Na-F+T) Group: Animals received 100 ppm Na-F + 2% black tea solution.

(T) Group: Animals received 2% black tea solution alone.

<sup>a-c</sup>Values within row with unlike superscripts differ significantly ( $p < 0.05$ ), according to ANOVA. Values represent mean±SEM of 10 animals per treatment.

#### 4. Discussions

Unlike previous studies that showed no effects of fluoride on body weight (Chioca et al. 2008; Pereira et al., 2009), the current impairment in weight gains of rats affected by fluoride is consistent with our earlier findings (El-lethey et al., 2010). Correspondingly, numerous studies have reported a drop in body growth of Na-F-intoxicated rats and mice (Vani and Reddy, 2000; Ekambaram and Paul, 2001; Trabelsi et al., 2001; Wang et al., 2004; Pushpalatha et al., 2005; Basha et al., 2010; Madhusudhan et al., 2010). Although feed and water consumption was not recorded here, the earlier reduction in feed intake as a result of Na-F-induced atrophic gastritis and poor gastrointestinal absorption (Das et al., 1994), with decreased water intake (Ross and Daston, 1995), might justify the current retardation in weight gains. Furthermore, the dental lesions observed in former studies in Na-F-treated rats (Shupe et al., 1984; Ekambaram and Paul, 2003), where the incisors became white and chalk-like with broken tips might impair the ability of animals to masticate food prior to swallowing, and therefore contribute to a reduced feed intake with a consequent decrease in body weight gain. Suppressed appetite and disturbed nutrient digestibility that can eventually lead to excessive breakdown of cellular macromolecules might also cause weight loss (Madhusudhan et al., 2010).

In agreement with our results, several studies revealed a positive effect of tea on body

weight reduction (Chantre and Lairon, 2002; Nagao et al., 2005; Chan et al., 2006). Investigations have proved the potential capacity of tea to inhibit lipogenic enzymes; gastric lipase and in a lower extent also the pancreatic lipase (Juhel et al., 2000). Moreover, tea extracts interfere with fat emulsification process, which occurs before enzymes act, and is indispensable for lipid intestinal absorption (Chantre and Lairon, 2002). The efficacy of tea extract to help with weight loss by speeding up fat oxidation process has been also evidenced (Dulloo et al., 1999). Other studies indicated the role of tea polyphenols to stimulate thermogenesis of brown fat; a thermogenic or heat-producing type of adipose tissue, resulting in increased energy expenditure (Han, et al., 1999; Nagao, et al., 2005; St-Onge, 2005). This thermogenic property of tea could reside primarily in a synergistic interaction between polyphenols and caffeine (Dulloo, et al., 1999; Dulloo, et al., 2000). Caffeine and theanine have been reported to strengthen the polyphenols effects on body weight control and fat accumulation (Zheng et al., 2004). In addition, black tea contains theaflavins, which compare equally to green tea catechins as antioxidants, and was evidenced to have a unique lipid-lowering function via inhibiting a key enzyme in the pathway of cholesterol synthesis (Ishikawa et al., 1997; Leung et al., 2001). Lastly, administration of tea might support weight loss by relatively sustaining satiety and suppressing appetite (Reinbach et al., 2009).

Here, the Na-F-induced suppressive effect on animals' weight gains was significantly stronger than that resulted from black tea. Simultaneous administration of black tea with Na-F successfully alleviated the marked drop in weights observed with fluoride alone to the same extent noticed with tea group. This observation could be of value to signify the potential impact of tea to counteract Na-F-induced harmful effects, generating a state like that provoked by tea alone.

Since the behavior of both humans and animals is the product of what occurs in the nervous system, behavioral analysis is an essential assay of neural function (Whishaw et al., 1999). The present study included monitoring motor activities as an example for motivated behaviour; the most common predictor of CNS dysfunction (Mullenix and Kernan, 1989).

Open field activity monitoring provides a non-invasive method for an accurate and comprehensive assessment of the motor activities of rats. Therefore, it is an ideal method for assessing the degree of locomotor impairment as well as to evaluate the efficacy of elements affecting muscle function and locomotion (Raben et al., 1998; Nagaraju et al., 2000). The number of line crossing is usually used as a measure of locomotor activity, ataxia and other gait disturbances, with high frequencies of this behaviour indicating increased locomotion activities (Eisenhaver and Murphy, 1998). In this study and as a trial to dissociate between "general activity" and "exploration", ambulation was only related to horizontal locomotion (amount of distance traveled) than vertical activity which is more sensitive to anxiety state of the individual (Lapin et al., 1995; Brown et al., 1999).

Although some investigations revealed altered locomotor behaviour after treatment with Na-F in rats (Mullenix et al., 1995; Paul et al., 1998; Ekambaram and Paul, 2001; Niu et al., 2008), a failure of Na-F to impair locomotor activities in open field test was noted in the present study. These results were in line with animal data reported earlier (Bera et al., 2007; Chioca et al., 2008). The Na-F-induced inconsistent effects on motor activity across different studies could be imputed to a variety of factors, including the somewhat larger group sizes in the positive studies and its use of mixed sex groups (vs. only males) in the present research as well as the variation in Na-F dose, duration of supplementation and the behavioural motor testing implemented. However, this major disparity in the literature highlights the need for further investigation and urges to replicate observational studies to evaluate the reproducibility of the effect.

A considerable amount of caffeine is consumed daily among individuals who drink tea. Caffeine content is higher in fermented than non-fermented teas, showing values of 3.86% in black tea versus 2.04% in green one (Komes et al., 2009). Administration of caffeine has been evidenced to have favorable effects on locomotion in rats (Haleem, 1994). In addition, theophylline; another alkaloid present in tea, is also accountable for enhanced locomotor ability (Haider et al., 1998). In the current study, supplementation with black tea had no influence on rats' locomotor activity in the open field test. Similarly, Haider et al. (1998) reported no changes in open field activities in tea-treated rats as measured by numbers of crossed squares, however home cage activity was reported to be increased. Lack of consistency of the effect of tea on home cage and open field activities might be attributable to stress effect of novelty on exposure to open field to an extent that suppress locomotor enhancing effects of tea stimulants. Data reported in our previous article (Kamel et al., 2010), confirmed this justification, where tea-treated rats exhibited higher levels of anxiety upon exposure to open field test as revealed in enhanced rearing activity. Also, tolerance development to caffeine-induced locomotion promoting effect might be experienced in the current study, where partial tolerance has been reported to occur following administration of high doses of caffeine for about a week (Haleem, 1994).

Motor performance deficits include slowing of movement, decreases in balance and muscle strength as well as coordination difficulty (Joseph et al., 1983; Diggles-Buckles, 1993; Kluger et al., 1997; Seidler et al., 2002). Tasks requiring coordinated control of motor and reflexive responses, such as the length of time an animal can traverse/balance on a wooden rod or plank are among tests which attempt to assess motor incapacities (Dean et al., 1981; Joseph and Lippa, 1986; Ingram et al., 1994). Our study revealed a poor performance of fluoride-intoxicated rats in motor-coordination tests that rely on balance and coordination. The present results are comparable to those from other study with mice, where inability to perform in motor-coordination tests increased with higher fluoride concentration in drinking water (Bhatnagar et al., 2002). Previous study has shown a shortening of rotarod endurance time in Na-F-treated rats (Ekambaram and Paul, 2001). However, Paul et al. (1998) indicated no change in the motor-coordination of rats after treating with Na-F. Since a defect in motivated locomotor behavior may lead to suppression of eating, this behavioral impairment may in part account for the current depression in weight gains reported earlier as a consequence for decreased feed intake.

A large body of evidences might explain the motor deficits currently observed with Na-F. Decline in antioxidant defense mechanisms have been postulated as a causative factor in decrements of motor function (Shukitt-Hale, 1999). So, increased vulnerability to effects of oxidative stress with inability to cope is thought to be contributing factor to the motor deficits experienced here with fluoride exposure; a prooxidant element. Free radicals-induced oxidative stress causing damage to muscular tissue is thought to be involved in the process of fatigue; or the inability to generate power as well as muscle soreness (Dekkers et al., 1996).

Motor impairment can be also attributed to disruptions in neuronal functioning. The current lessening in motor performance was concomitant with marked neuronal dysfunction reported in the earlier complementary part of our study, as a result of increased levels of oxidative stress (Kamel et al., 2010). Such increase in free radicals in neuronal cell bodies could be correlated with loss of neurons in synaptic structures in neuromuscular junctions. The disturbed gait observed here in fluorotic rats confirms the dysfunction of neurotransmission caused by fluoride intake (Bhatnagar et al., 2006). Further proof derived from a fluoride study with rabbits, where the observed neurotoxic changes in brain suggested a direct action of fluoride upon the nerve tissue which was responsible for central nervous system problems such as tremors, seizures, and paralysis indicating brain dysfunction (Shashi, 2003).

In conditions with a high level of fluoride present, skeletal muscle necrosis might occur as a result of impairment of energy metabolism via destroyed stability of mitochondrial membrane with decreased activities of mitochondrial enzymes (Pang et al., 1996). Vani and Reddy (2000) also displayed an affection of both brain and muscles with fluorosis with inhibition of some enzymes associated with free radical metabolism, energy production and transport as well as synaptic transmission in mice.

Moreover, deficits in motor performance are thought to be the results of cerebellum disorders, where cerebellum is known to be crucial for functions related to movement, gait, posture, and balance (Ivry et al., 1988; Bickford et al., 1992; Bickford, 1993; Joyal et al., 1996; Konarski et al., 2005). As such, one of the most important signs of cerebellar damage is walking ataxia (Morton and Bastian, 2004). Our former study (Kamel et al., 2010), supported this notion displaying marked neurological alterations in cerebellum of Na-F-administered rats. Evidence continues to come demonstrating that fluoride may disrupt cerebellum, where ingested fluoride was retained by the cerebellum, of rats and mice, interfering with its physiology and inducing

neurotoxicity, cell damage, and even cell death (Trabelsi et al., 2001; Shivarajashankara, 2002b; Trivedi et al., 2007; Bouaziz et al., 2010).

It is well established that mammalian spinal cord contains the neural circuitry required to generate a variety of rhythmic behaviors, including locomotion (Grillner, 1981). Hence, the indications of spinal cord involvement in fluorosis might also answer for the motor deficits observed here (Mrabet et al., 1995).

Locomotion, a cholinergically driven mechanism, is the most important acetylcholine-mediated behavior, where it involves by far the greatest number of cholinergic neurons (Day et al., 1991; Mitsushima et al., 1998; De Parada et al., 2002). The involvement of acetylcholine (ACh) in locomotion includes not only neuromuscular transmission, but also nerve-nerve transmission. It was shown that functional activity of cholinergic system; ACh-acetylcholinesterase (AChE) was lower in hypokinetic rats (Abzalov et al., 1997). Moreover, AChE deficit has been reported to leads to marked neuromuscular alterations in hind limb muscle functioning and a prominent symptom was the lack of resistance to fatigue (Mouisel et al., 2006). Since, a depletion of AChE activities in Na-F-treated rats was documented in our previous investigation (Kamel et al., 2010), this modulation of the central cholinergic mechanism probably accounts for inhibited motor activities seen in Na-F-exposed animals (Heiland and Greenfield, 1999).

Last of all, suppression of spontaneous motor activity suggests that fluoride has, by a central action, inhibited motivation of these animals to exhibit locomotor behavior (Paul et al., 1998).

Previous research showed that, although some flavonoids-rich diets were effective in reversing neuronal deficits, only a few enhanced motor performance (Joseph et al., 1999; Galli et al., 2002; Shukitt-Hale et al., 2005; 2006; 2008). Such findings point that it might be more difficult to reverse motor deficits than decline in cognitive function, where enhancement of motor behaviors may require recruitment of additional signaling pathway and may involve peripheral mediation (Shukitt-Hale et al., 2006). Although several studies have started to show a significant effect of tea in forestalling cognitive decline, to date, little is known about the effects of black tea on psychomotor function. Day-long consumption of black tea has been shown to improve aspects of psychomotor performance (Hindmarch et al., 2000). Also, prominent improvement in motor deficits was shown in rats receiving black tea extract (Chaturvedi et al., 2006). Compatible results derived from the current research which, as far as we can determine, is the first study to demonstrate a



profound restorative effect of black tea on Na-F-induced motor impairment in rats during psychomotor testing.

Research suggests that flavonoids may exert their beneficial effects either through their ability to lower oxidative stress and inflammation or directly by altering the signaling involved in neuronal communication, calcium buffering ability, neuroprotective stress shock proteins, plasticity, and stress signaling pathways. These interventions, in turn, may exert protection against motor dysfunction (Shukitt-Hale et al., 2008). Furthermore, the potential effects of tea consumption on the skeleton were reported where tea was associated with benefits on bone density (Hegarty et al., 2000; Wu et al., 2002; Chen et al., 2003; Devine et al., 2007). This beneficial influence was proposed to be mediated via a potent stimulatory effect of tea-derived flavonoids and lignans on osteoblast function (Cabrera et al., 2006; Whelan et al., 2006). It appears that the rejuvenating effects of tea on psychomotor performance was not entirely due to caffeine per se; where other intrinsic biologically active ingredients appear to be responsible for the beverage's inverse association with motor deficits. Black tea has been credited with capacity to modulate motor function via presence of theaflavins which have a potentiating effect on the contractile mechanism of mammalian skeletal muscle (Basu et al., 2005). The potential application of theaflavins for improving physical performance and recovery from high intensity exercise has been also evidenced (Arent et al., 2010).

In conclusion and as a trial to correlate the two complementary parts of our study, we find that fluoride intoxication-induced marked neurodegenerative changes in the brain of rats might form the neural basis for impaired motor function of the body. In view of the fact that humans incorporate fluoride into the skeleton about 18 times more readily than rats (Turner et al., 1992), understanding of the problem of fluoride conveying an increased risk for motor deficits, can further alert to be more vigilant and to consider preventive measures more seriously as the best approach to tackle this public menace. The use of black tea is a promising avenue that could help bring about substantial reduction of the fluoride-induced enormous healthcare costs in individuals.

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## Factors Influencing Commercialization of Nano and Biotechnologies in Agriculture Sector of Iran

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**Abstract:** Faculty members and researchers in Agricultural Biotechnology Research Center in Iran were surveyed in order to explore their perception about the factors influencing the commercialization of nano and biotechnologies in agricultural sector. The data was analyzed by using ordinal factor analysis technique. Based on the perception of the respondents and ordinal factor analysis, factors were categorized into seven groups, namely infrastructural, production, management, economic, research.

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### 1. Introduction

Modern technologies can play an important role in increasing production and improving the quality of food produced by farmers. Many believe that modern technologies will secure growing world food needs as well as deliver a huge range of environmental, health and economic advantages (Wheeler, 2005).

Modern technology such as nano has the potential to revolutionize agriculture and food systems. Agricultural and food systems security, disease treatment delivery system, new tools for molecular and cellular biology, new material for pathogen detection, protection of environment, and education of the public and future workforce are examples of the important links of nanotechnology to the science and engineering of agriculture and food systems (Scott and Chen, 2003).

However, full potential of these technologies has not been realized yet and in this regard, examining the factors which influence the commercialization should be considered as a major step toward widespread application of these modern technologies. This would enable nano and biotechnologies to be part of a comprehensive development strategy for agricultural sector.

A major issue that will affect successful applications of new technology such as bio and nanotechnologies to agriculture is the regulatory climatic governing the release of new products. Developing societies will need to develop and implement regulatory measures to manage any environmental, economic, health and social risks associated with genetic engineering (Ozor, 2008).

But the challenges of bringing new technology to market in the agricultural industry are changing – it is no longer adequate to conceive a new invention and convince farmers with a strong marketing campaign that they should adopt the technology that results from this invention. The business challenges in the commercialization of agricultural technology are both more complex and broader with respect to those who will be impacted by that technology (Boehlje, 2004).

The commercialization of new technologies, or the process of introducing new technology to market, has been a particular facet garnering much attention. Patent protection and capital investment are necessary components for the effective commercialization of innovations (Boulay et al., 2008).

Commercialization entails a sequence of steps to achieve market entry of new technologies, processes, and products. Jolly (1997) outlined a five-stage model of the commercialization process. Technology exploration begins with the imaging stage. This stage primarily addresses the basic research related to a new concept. The second stage proposed by Jolly is the incubating stage in which generic market applications and technology concepts are examined. In the demonstrating stage, the technology is moved into products with market application through various means such as prototyping. The promoting stage is the beginning of market entry and expansion. Finally, the sustaining stage focuses on the long-term market placement of the products. New technologies are a part of each of



these stages at some point in their development (Boulay et al., 2008).

Naseri in his thesis entitled commercialization, processes and models in developing and developed countries introduced some factors in the way of commercialization of nanotechnology: human, management, social, cultural and economic factors (Droby et al 2009, Port, 1989).

Oriakhi (2004) in his research about commercialization of nanotechnologies reported that beliefs and convictions of consumers about nano, cultural and social challenges, lack of coordination between agencies, lack of targeted research projects, management challenges, lack of financial resources and uncertainty of industries about universities have affected agricultural commercialization in nanotechnology.

Different factors influence the process of commercialization of nano product. The most important factor in launching a new business is intellectual property rights which is the first step in commercialization of nano (Palminera, 2007).

Iran has adopted its own nanotechnology programs with a specific focus on agricultural applications. The Iranian Agricultural Ministry is supporting a consortium of 35 laboratories working on a project to expand the use of nanotechnology in agro sector (Joseph and Morrison, 2006).

Rezaee (2008) in his research about recognizing mechanisms in diffusion of nanotechnology in agriculture sector of Iran, pointed out to the policy, infrastructure, financial, educational, and regulatory factors which influence the diffusion of nanotechnology.

Hosseini and Alikarami (2009) indicated that extension/education, environmental, research and economic factors have positive impacts on the adoption of biotechnology by horticultural producers in Iran. The question is what are the factors influencing the commercialization of nano and biotechnologies in agricultural sector of Iran? The purpose of this study is to determine the factors in commercialization of nano and biotechnologies in agricultural sector of Iran.

## 2. Material and Methods

A series of in-depth interviews were conducted with some senior experts in the nanotechnology to examine the validity of questionnaire. A questionnaire was developed based on these interviews and relevant literature. The questionnaire included both open-ended and fixed-choice questions. The open-ended questions were used to gather information not covered by the fixed-choice questions and to encourage participants to

provide feedback. The total population for this study was 52 faculty members and researchers at Agricultural Biotechnology Research Center (ABRC). Data were collected by using questionnaire through interview schedules.

The data was analyzed by using ordinal factor analysis technique. The basic idea of factor analysis is the following. For given set of observed variables  $Y_1, \dots, Y_n$  one wants to find a set of latent variables  $\xi_1, \dots, \xi_k$ ,  $k < n$  that contain essentially the same information. The last version of their statistical software, named LISREL 8.8 can handle such analysis. Briefly, we used: 1) Goodness of fitness which its null hypothesis indicates that the model is valid (we prefer to accept the null hypothesis, i.e.,  $p\text{-value} > 0.05$ ); 2) RMSEA (Root Mean Square Error of Approximation) which takes into account the error of approximation in the population and asks "How well would the model fit the population covariance matrix if it were available?" ( $p\text{-value}$  less than 0.05 indicates good fit, and higher than 0.08 represents reasonable errors of approximation in the population).

## 3. Results

Table 1 summarizes the demographic profile and descriptive statistics of respondents. The results of descriptive statistics indicated that majority of extension experts were male with a mean age of 33 years old. Majority of respondents had a master degree with major in agriculture.

Table 2 shows the grouping of factors (determined via ordinal factor analysis) into seven latent variables. As the ordinal factor analysis showed, the factors were categorized into seven groups, namely infrastructural, production, management, economic, research, social/cultural and technical factors ordered by the magnitude of their impact.

Table 1. Personal Characteristics of respondents

Sex	Female (26.9%)	Male (73.1%)
Age/year	Mean=33	
Degree	Master Degree (57.7%)	PhD (42.3%)

Table 2. Classification of factors by Using Ordinal Factor Analysis

Categories	Variance by Factor
Infrastructural	13.78
Production	13.71
Management	12.16
Economic	9.75
Research	9.19
Social/Cultural	8.06
Technical	6.41
Total	73.06

The value of RMSEA was 0.709 which shows the reasonable fit of model.

#### 4. Discussions

As the ordinal factor analysis showed, factors were categorized into seven factors namely, infrastructural, production, management, economic, research, social/cultural and technical factors ordered by the magnitude of their impact. The factors were then ordered by the magnitude of their impact (fig.1).

A wide range of economic, social, physical and technical challenges influences adoption of agricultural production technology. Wheeler (2005) citing Rogers and Pannell pointed the factors which influence the adoption of new innovations by farmers. She mentioned factors such as perception about risk and profitability; uncertainty and certainty about adoption; amount of required information and attitude about risk and uncertainty.

The findings show that infrastructural factors are the most important factors, a result that echoes the findings of Oriakhi (2004) and Droby et al (2009). A regulatory process should ensure the democratic control of and public participation in decision making on nanotechnology and other new technologies. It is recommend the initiation of a wide range of participatory processes to enable direct input from the general public into new technology assessment and determination of priorities and principles for public policy, R&D and legislation (Johnston et al., 2007).

Production factors are always potentially important factors in development of modern technology such as nano and biotechnologies. It is well known that uncertainties and lack of knowledge of potential effects and impacts of new technologies, or the lack of a clear communication of risks and benefits can raise concern amongst public (Chaudhry, et al., 2008).

The findings also reflect an important fact that negative attitudes of consumers and producers directly impact the commercialization of nano and biotechnologies in agricultural sector... This has been pointed out by several authors including Droby et al (2009) and Port (1989).

Like any other new technology, public confidence, trust and acceptance are likely to be one of the key factors determining the commercialization of nano and biotechnologies in agriculture and the public should be educated that explain the value-added of these modern technologies (Scott and Chen, 2003).

It is becoming increasingly clear that commercialization of nano and biotechnologies require a holistic and tightly integrated regulatory

framework for dealing with the range of health, ecological, economic, and socio-political issues that this technology raises (Johnston et al., 2007).

As in the case of any complex technology impacting wide range of processes and developments, the gains from modern biotechnology are accompanied with certain negative effects and concerns. The nature and extent of the positive and negative impacts will depend on the choice of the technique, place and mode of application of the technique, ultimate use of the product, concerned policies and regulatory measures, including risk assessment and management ability, and finally on the need, priority, aspiration and capacity of individual countries (Ameden, et al., 2005).

Overall, these findings suggest the commercialization of nano and biotechnologies varies from country to country and therefore in Iran like many countries requires a location-specific approach.

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## Ordinal Factor Analysis of Constraints in Iran's Sustainable Agricultural Development (Case Study: Greenhouse Production)

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**Abstract:** Greenhouse Owners in the Province of Tehran were surveyed in order to explore their perception about the constraints in developing sustainable agriculture. The methodology used in this study involved a combination of descriptive and quantitative research. The total population was 306 greenhouse owners in the Province of Tehran. As the ordinal factor analysis showed, the constraints were categorized into four groups, namely economic, social, regulatory and technical, ordered by the magnitude of their impact.

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**Keywords:** Sustainable agriculture; greenhouse; Iran; Tehran

### 1. Introduction

Agriculture is considered as a critical sector in the world economy. It contributes 24% of global Gross Domestic Product and provides employment to 1.3 billion people or 22% of the world's population. In many of the developing countries, increasing agricultural production has been one of the most important priorities for agricultural development programs (Subedi et al., 2009).

Agriculture is essential to human survival and societal development. With worldwide human population growth and economic development, increasing demand for agricultural products has placed substantial pressures on agriculture and natural resources; this in turn has caused environmental pollution and ecological degradation. Agricultural sustainability has become a critical problem that is central to the sustainable development of complex socio-economic–natural systems (Zhao et al. 2007).

To be sustainable, agriculture has to move beyond these limited economic ideologies and seek creative solutions to the questions of fair pricing, cost internalization, food security, the right to an adequate livelihood, and the multifunctional role of agriculture. Modernization has created a social “black hole,” mindlessly destroying anything that smacks of rural culture. To be sustainable, agriculture has to be culturally sensitive and empowering and should nurture the cultural renaissance of the countryside (Perlas, 2011).

For sustainable agriculture to succeed, policy formulation must arise in a new way. Policy processes must be enabling and participatory,

creating the conditions for sustainable development based more on locally available resources and on local skills and knowledge. Effective policy processes will have to bring together a range of actors and institutions for creative interaction and address multiple realities and unpredictability. What is required is the development of approaches that put participation, negotiation, and mediation at the centre of policy formulation so as to create a much wider common ownership in the practices. This is a central challenge for sustainable agriculture (Roling and Pretty, 1997).

This is no exception for Iran and government of Iran in response to the adverse environmental impacts of high chemical usages has proposed several strategies and the adoption of sustainable agriculture is considered as a major recommendation.

Agriculture comprises a considerably high percentage of production and employment in Iran. It provides employment to about 25% of the labor force, accounts for 25% of the Gross National Product (GNP), contributes over 4/5 of total domestic food supply, 1/3 of non-oil exports (excluding carpet exports), and 9/10 of the raw material demand of national industries (Karbasiyoon, 2007).

Although, sustainable agriculture offers tremendous impacts on increasing production and eventually enhancing the food security in the developing countries, but it presents challenges that impede its progress and development. Potential challenges are lack of training for farmers; lack of knowledge and skills among farmers; financial

constraints and legislative, policy and regulatory impediments.

Poor funding in the research and development of sustainable agriculture technologies in the developing countries is considered another major challenge and financial helps from developed countries and donor agencies can not fulfill their needs.

Among the challenges in developing sustainable agriculture is poor regulatory environment which with no doubt affect the successful application of technologies related with sustainable agriculture. Developing societies will need to develop and implement regulatory measures to manage any environmental, economic, health and social risks associated with new technologies (Ozor, 2008).

Most successes in sustainable agriculture, though, are still localized. They are simply islands of success. This is because an overarching element, a favorable policy environment, is missing. Most policies still actively encourage farming that is dependent on external inputs and technologies. It is these policy frameworks that are one of the principal barriers to a more sustainable agriculture (Roling and Pretty, 1997).

Many people express serious doubts about the profitability of sustainable agriculture, in terms of the costs and returns from each farming system. It is rather difficult to draw a conclusion as to whether sustainable agriculture is economically viable. The profitability of farming may depend on which factors are taken into account, notably market and shadow prices, static and dynamic time dimensions and positive and negative externalities. However, for agricultural systems to be sustainable implies that farm investment and other input costs will yield a flow of monetary (market) and non-monetary (non-market) benefits in the long term (Jitsanguan, 2001).

In Iran, like the other developing countries, where the majority of farmers are smallholders and average land holding size is less than one hectare, farmers' immediate concern for agricultural development is how to increase crop yield, income, and food security and reduce the risk of crop failure (Brady, 1990; Pretty, 1995). The overwhelming majority of farmers lack the capital required for the purchase of inputs, but normally have an adequate labor force.

Ommani and others ((2009) citing chizari, Lindner and Lashkarara (2001) reported that major barriers hampering adoption of sustainable agriculture practices in Iran included: limited financial returns for farmers, limited farmer knowledge of sustainable agriculture principles and methods, low levels of farmer education, government

rules and regulations, problems with soil erosion and lack of water, and a low level of extension agent knowledge with respect to sustainable agriculture.

It is important to point out that even small effort to informing farmers and increasing their knowledge about the sustainable agriculture can have big results. However, the promise has yet to be realized due to the lack of information among rural communities. Therefore, it is necessary to identify the constraints and remove the impediments faced by rural population.

Poursaeed and others (2010) citing Karami and Mansoorabadi (2008) indicated that much of the research effort in (adoption of) sustainable agriculture has been fragmented, with little coordination and integration. Little substantive research has investigated the beliefs and motivations that drive farmers' decisions about adoption of sustainable agricultural practices. Thus, in view of biophysical and socio-economic conditions in the study area, It is important to examine constraints in development of sustainable agriculture were selected in Iran.

The purpose of this study is twofold. First, it determines the key constraints in development of sustainable agriculture in Iran. Secondly, it provides suggestions for policy recommendations to overcome these constraints.

## 2. Material and Methods

The methodology used in this study involved a three stage combination of descriptive and quantitative research. Stage one involved a series of in-depth interviews with some senior experts in the Ministry of Agriculture to examine the validity of questionnaire. A questionnaire was developed based on these interviews and relevant literature. Content and face validity were established by a panel of experts consisting of faculty members at Science and Research Branch, Islamic Azad University, and some specialists in the Ministry of Agriculture. Minor wording and structuring of the instrument were made based on the recommendation of the panel of experts.

Measuring greenhouses' attitudes towards the constraints in developing sustainable agriculture has been achieved largely through structured questionnaire surveys. The usual questionnaire approach to measure attitude is to include a range of semantic-differential (with good/bad options for example) and Likert items (ranging from 1 as strongly disagree to 5 as strongly agree) to operationalize the attitude construct.

The final questionnaire was divided into several sections. The first section was designed to gather information about personal characteristics of respondents. The second section was designed to



measure the attitudes of greenhouse owners about the constraints in developing sustainable agriculture. The respondents were asked to indicate their agreements with statements by marking their response on a five point Likert-type scale.

Stage two involved a pilot study with 30 greenhouse owners who had not been interviewed before the earlier exercise of determining the reliability of the questionnaire for the study. Computed Cronbach's Alpha score was 91.3%, which indicated that the questionnaire was highly reliable.

Stage three involved a survey held in May 2010. The research population included all greenhouse owners, i.e., those owners who were registered in the Ministry of Agriculture as the owners of greenhouse, in the provinces of Tehran (N = 1787). By multi-stage cluster sampling technique, 306 were selected by using Cochran Formula. Data were collected through interview schedules.

The data was also analyzed by using ordinal factor analysis technique. The basic idea of factor analysis is the following. For given set of observed variables  $Y_1, \dots, Y_n$  one wants to find a set of latent variables  $\xi_1, \dots, \xi_k$ ,  $k < n$  that contain essentially the same information. The last version of their statistical software, named LISREL 8.8 can handle such analysis. Briefly, we used: 1) Goodness of fitness which its null hypothesis indicates that the model is valid (we prefer to accept the null hypothesis, i.e., p-value > 0.05); 2) RMSEA (Root Mean Square Error of Approximation) which takes into account the error of approximation in the population and asks "How well would the model fit the population covariance matrix if it were available?" (p-value less than 0.05 indicates good fit, and higher than 0.08 represents reasonable errors of approximation in the population). of least important species and E is the evenness index.

### 3. Results

The results of descriptive statistics indicated that the respondents were all male, with average age of 43.8 years old and more than 46 percent had degree under diploma. More than 80 percent greenhouses were non hydroponic and the main production was vegetables. Majority of greenhouse owners had less than 5 years working experience. Also Majority of greenhouses area was less than 5000 m<sup>2</sup>.

In order to finding the perception of respondents about their attitudes about farming, economical, social, policy making and extension and education factors influencing the sustainable agriculture, they were asked to express their views. Table 2 displays the respondents' means about the

five factors. As can be seen the highest mean number refers to the economic factor (mean= 4.21) and lowest mean number refers to social factor (mean=3.83).

This shows that greenhouse owners are mostly regarded economic factors as the main reason to adopt new methods in the sustainable agriculture and social factors is not considered as an important element in adopting sustainable agriculture related methods.

Table 1. Means of respondents' views about the factors influencing the sustainable agriculture (1=strongly disagree; 5=strongly agree).

Factors	Mean	SD
Farming	3.9	0.66
Economic	4.2	0.64
Social	3.8	0.87
Policy making	4.0	0.70
Education	3.9	0.97

Implementation of "ordinal factor analysis" along the structural equation model (SEM) summarizes all constraints into four factors; economic, social, technical and regulatory given by Table 4. Goodness of the model has been verified by several statistics such as the goodness of fit-test (p-value=0.00) and the RMSEA (p-value=0.041). As the ordinal factor analysis showed, the constraints were categorized into four groups, namely economic, social, regulatory and technical, ordered by the magnitude of their impact.

Table 2. Classification of constraints in developing sustainable agriculture by Using Ordinal Factor Analysis

Factor	Variance
Social	11.90
Regulatory	11.40
Economic	22.25
Technical	10.99
Total	56.54

### 4. Discussions

A wide range of economic, social, physical and technical constraints influences adoption of agricultural production technology. Wheeler citing

Rogers and Pannell pointed the factors such as perception about risk and profitability; uncertainty and certainty about adoption; amount of required information and attitude about risk and uncertainty.

Economic factors also contribute to sustainability and it is consistent with the results of study by Ommani and others (2009) that income level of farmers and their poverty would affect sustainability in rural areas of Iran. Developing countries have to invest in the sustainable agricultural related technologies and meanwhile considering whether the target audience are effectively reached or are interested in the technology.

The findings also show that social and cultural constraints in some developing countries impede the development of sustainable agriculture. Public confidence, trust and acceptance are key factors which determine the success or failure of sustainable agriculture. It is well known that uncertainties and lack of knowledge of potential effects and impacts of new technologies, or the lack of a clear communication of risks and benefits can raise concern amongst public.

Based on the perception of respondents, the one of the constraint in development of sustainable agricultural was regulatory constraints. The findings reflect an important fact, namely that a sound regulatory and policy environment is a necessary prerequisite for developing sustainable agriculture

A regulatory process should ensure the initiation of a wide range of participatory processes to enable direct input from the general public into assessment and determination of priorities and principles for public policy, R&D and legislation.

Because sustainability is a function of various economic, environmental, ecological, social, and physical goals and objectives, it must inevitably involve multi-objective tradeoffs in a multidisciplinary and multi-participatory decision-making process (Ommani et al., 2009).

The perception of greenhouse owners about the constraints in developing sustainable agriculture was discussed in this article. The results demonstrated that regulatory, economic, technical and social issues are the main constraints in developing sustainable agriculture. Successful development of the sustainable agriculture in Iran will depend on the appropriate regulatory environment and the authorities should develop policies that would overcome the constraints in developing sustainable agriculture.

In Iran like some of the developing countries, there is not a clear understanding about the sustainable agriculture and policy makers have difficulty in prioritizing the policies and strategies. In

this regard, public involvement will enhance the development of sustainable agriculture.

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## Effect of Lactic Acid Bacteria against Heavy Metals Toxicity in Rats

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**Abstract:** Cadmium and lead are highly toxic metals; people are exposed to them primarily through food and water. Therefore the study aimed to estimate the effect of lactic acid bacteria against toxicity induced by contaminated diet with lead and cadmium mixture in rats. Forty two Albino male rats (Sprague Dowely strain) of an average weight  $130 \pm 10$  g were divided into 6 groups each group contains 7 rats. G1: fed on basal diet (negative control); G2: fed on contaminated food with 0.025mg lead acetate/kg diet + 0.025mg cadmium chloride /kg diet (positive control); G3: fed on basal diet supplemented with strain 1 of lactic acid bacteria (*Streptococcus thermophilus*); G4: fed on basal diet supplemented with strain 2 of lactic acid bacteria (*Lactobacillus bulgaricus*). The other two groups received heavy metals contaminated diet supplemented with strain1and strain2 lactic acid bacteria for 6 weeks. The results revealed that positive control gave a highly significant increased in liver functions (alanine aminotransferase (ALT) and aspartate minotransferase (AST) activities), kidney functions (creatinine and urea); significantly decreased in glutathione peroxidase (GPX), blood hemoglobin, body weight and feed efficiency ratio. However lactic acid strains supplemented to heavy metals treated group significantly improved the in glutathione peroxydase, blood hemoglobin, body weight and feed efficiency ratio and the elevation of ALT, AST, creatinine and urea. The results also showed that the group received basal diet supplemented with strain 1 (*Streptococcus thermophilus*) and strain 2 (*Lactobacillus bulgaricus*) has beneficial health effects on animals. It was noticed that the group received strain 1 (*Streptococcus thermophilus*) showed better results than strain 2 (*Lactobacillus bulgaricus*). The results of histopathology obtained also indicate that tested lactic acid bacteria strains have an effective role against the toxicity induced by lead and cadmium. These results indicated the potential protective action of tested lactic acid strains against lead and cadmium toxicity as well as their beneficial health effects. This may be due the ability of lactic acid strains to bind heavy metals, the DNA protective effect of LAB and thought to have several presumably beneficial effects on immune function. In addition LAB decreased the amount of administered carcinogens reaching the blood. [Abou-Baker Salim, Ibrahim H. Badawy and Seham S. Kassem. Effect of Lactic Acid Bacteria against Heavy Metals Toxicity in Rats. Journal of American Science 2011;7(4):264-274]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Key Words:** lactic acid bacteria, Heavy Metals, lead, cadmium.

### 1. Introduction:

Heavy metals are undegradable compounds that may exist in number of different inorganic and organic forms. Some heavy metals such as Fe, Cu and Zn are essential trace elements but others such as Cd and Pb have no advantageous biological function and are toxic even in very small amounts. Cd, Pb and Hg are regarded as the most toxic heavy metals (Halttunen, 2007).

Lead and cadmium are now recognized to be two of most contaminants in the environment. They released into the environment from natural and anthropogenic sources contaminating food and water. Chronic oral ingestion of cadmium and lead is associated with adverse effects in the skin, internal organs and nervous system. Lead and cadmium are known to produce various adverse effects on reproduction. Pregnancy causes many physiological and biochemical changes that may affect the metabolism of trace elements in the dam. Chronic toxicity symptoms are renal malfunction, anemia,

brain and liver damage, cancer (Santos *et al.*, 2004; Chandra and Banerjee, 2004).

To protect man from the harmful effect of lead, the intake of the metal should not exceed 300 µg/60Kg body weight (b.w.) and it should not exceed 25µg/Kg b.w. for young children (WHO, 1987). Based on the renal toxicity of cadmium, the Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Additives (JECFA, 2003) has set a provisional tolerable weekly intake (PTWI) of 7 µg Cd/kg b.w./week. However, recent reports have challenged this guideline as too high, since according to a recent meta-analysis of available data, an increased concentration of beta-2-microglobulin, a biomarker for proteinuria, was detected at an exposure level comparable to a PTWI of only 3 µg Cd/kg b.w.(Omarova and Phillips, 2007).

Lactic acid bacteria (LAB) are ubiquitous in fermented and non-fermented foods and are common components of the human commensal microflora.

They are a group of bacteria characterized by their ability to synthesize lactic acid and are widely used in food manufacturing for their beneficial technological properties and positive effects on health. Many of their beneficial properties are related to their capacity to adhere or bind to different targets (Nybom *et al.* 2007). The LAB could be comprised of about 20 genera. *Lactobacillus* is largest of these genera, comprising around 80 recognized species (Axelsson, 2004).

Numerous investigations indicated that LAB have beneficial health effects in humans (Saxelin *et al.*, 2005). One of the effects identified is the protection against toxins contained in foods such as heterocyclic aromatic amines, polycyclic aromatic hydrocarbons, mycotoxins and reactive oxygen species (Stidl *et al.*, 2007).

Lactic acid bacteria have been reported to remove heavy metals (Halttunen, 2007), cyanotoxins (Meriluoto *et al.* 2005 and Nybom *et al.*, 2007) and mycotoxins (Haskard *et al.*, 2001 and Turbic *et al.*, 2002) from aqueous solution in-vitro. The removal of heavy metals, cyanotoxins and mycotoxins from aqueous solution by LAB has been observed to be strain dependent, and the most efficient strains in the removal of these compounds vary between toxins (Halttunen 2007 and Nybom *et al.* 2007). Heavy metals and aflatoxin B1 (AFB1) have been reported to passively bind to the bacterial surface by electrostatic and hydrophobic interactions (Lahtinen *et al.*, 2004 and Halttunen, 2007) respectively, whereas microcystins may also be metabolized (Nybom *et al.*, 2007).

The reported metal removal by different inactivated biomasses, and the toxin removal capacity of lactic acid bacteria in vitro, inspired us to assess the ability of lactic acid bacteria to remove or reduce the toxicity of cadmium, and lead in vivo. Therefore this study was conducted to investigate the effect of lactic acid bacteria on the toxicity induced by lead and cadmium mixture.

## 2. Materials and methods

### 1. Chemicals

Cadmium chloride, lead acetate and other chemicals used in this study were obtained from Sigma Chemical Company (St. Louis, USA).

### 2. Diagnostic Kits

Different Commercial diagnostic kits used were purchased from BioMerieux Company (L'Etoile/France and Eagle Diagnostics (Dollas, TX, USA).

### 3. Media

MRS Broth and MRS Agar were obtained from Oxoid Ltd., Wade Road, Basingstoke, U.K.

### 4. Organisms

Two strains of probiotic bacteria obtained from the agent of Chr. Hansens Laboratory Denmark A/S were used in this study: Strain 1 (*Streptococcus thermophilus* CH-1) and Strain 2 (*Lactobacillus delbrekii ss. bulgaricus* CH-2)

### 5. Animals

Forty two albino male rats (Sprague Dowely strain) with an average weight  $130 \pm 10$  g were obtained from animal house of National Research Center. The experiment was carried out in the experimental animal house of NRC. Rats were divided into 6 equal groups and housed in galvanized metal cages. Food and water were supplied and libtum for 6 weeks. All rats were adapted for three days on the control diet before the beginning of the experiment.

### 6. Activation of tested bacterial strains

*Streptococcus thermophilus* CH-1 and *Lactobacillus delbrekii ss. bulgaricus* CH-2 were activated according to DeMan, *et al.*, (1960). *Streptococcus thermophilus* CH-1 and anaerobically incubated at 37°C for 24h.

### 7. Preparation of bacterial strains

Strain1 and 2 were prepared at National Research Centre (NRC) in vitro as the following: 5.0 ml of the activated tested bacteria was added to 500ml of MRS broth. After that it was incubated at the optimum temperature (37°C anaerobic conditions) to 24 hrs then it was centrifugated at (3000 r.p.m at 4°C for 20 min) to harvest the cells. Dehydration was obtained by addition 50 g of defatted soy protein (soy protein without fat) to cells in big Petri dishes and the cells were incubated under vacuum incubator at 40°C overnight until it seemed like as thin slice or skins. The viability of the cells was tested on MRS agar plates then, the strain was chopped and made as a powder containing  $10^9$  of bacteria/g.

### 8. Preparation of contaminated diet

Mixture of 0.025mg lead acetate plus 0.025mg cadmium chloride was added to every kilogram diet.

### 9. Experimental animal design

The forty two rats were divided to 6 groups as following: Group1 (G1): fed on basal diet as negative control, which was prepared according to the method described by Campbell, (1963). Group 2 (G2): fed on contaminated diet with 0.025mg lead acetate/kg



diet plus 0.025mg cadmium chloride/kg diet (Positive control). Group 3 (G3): fed on basal diet plus strain 1 of lactic acid bacteria (*Streptococcus thermophilus*). Group 4 (G4): fed on basal diet + strain 2 of lactic acid bacteria (*Lactobacillus bulgaricus*). Group 5 (G5): fed on contaminated diet with (0.025mg lead acetate/kg diet plus 0.025mg cadmium chloride/kg diet) plus strain 1 *Streptococcus thermophilus*. Group 6 (G6): fed on contaminated diet with (0.025mg lead acetate/kg diet plus 0.025mg cadmium chloride/kg diet) plus strain 2 *Lactobacillus bulgaricus*.

### 10. Biological evaluation

During the experimental period (6 weeks) the consumed diet was recorded every day (Food Intake), and body weight was recorded every week. Biological evaluation of different groups was carried out by determination of body weight gain (BWG) and food efficiency ratio (FER) according to Chapman *et al.*, (1959).

### 11. Biochemical analyses

At the end of the experiment, rats were fasted overnight (about 12 hrs) and anesthetized with diethyl ether. Blood samples were collected in clean dry centrifuge tubes from hepatic portal vein. All blood samples were centrifuged for 15 minutes at 3000 rpm to separate the serum. Serum was carefully separated and transferred into dry clean eppendorf tubes and kept frozen at (-20°C) till analysis, according to Jacobs *et al.* (2001). Blood samples were used for determination the following parameters: assayed serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activities (liver functions) according to method of Henry (1974); Glutathione peroxidase was determined as  $\mu\text{g/ml}$  according to Paglia and Valentine, (1967). Kidney functions were determined as serum urea according to Carawy, (1955) and serum creatinine according to Larsen, (1972). Blood hemoglobin was estimated according to Jacobs *et al.* (2001).

### 12. Determination of lead and cadmium level in blood of rats

Lead and cadmium concentrations were determined according to the method described by Davis *et al.* (2003) using atomic absorption spectrometry (Solaar M6 Dual Zeeman AAS Spectrometer, Thermo Electron Spectroscopy Ltd., Cambridge, England) either by flame or graphite furnace method depending on the metal concentration. In each analysis, samples spiked with lead and cadmium as quality control samples.

### 13. Organs weight:

After taking retro orbital blood samples, each rat was rapidly opened, the liver and kidney were removed cleaned in saline solution and dried then weighted and kept in a formalin solution (10% v/v) according to the method described by Drury and Wallington, (1980).

### 14. Histopathological Examination:

At the end of the experiment, rats from each group were anesthetized with light ether then sacrificed by decapitation. After animal dissection, the liver, kidneys, heart, spleen and brain were removed, thoroughly washed with a physiological saline (0.9% NaCl) solution and blotted on filter paper. Organs specimens were rapidly fixed in Bruin's solution for 4h then retained in 70% alcohol until processing. The fixed specimens were processed using a conventional paraffin embedding technique. From the prepared paraffin blocks, 5 mm thick sections were obtained and stained with hematoxylin and eosin (HE) for light microscopic examination (Culling, 1983). Specimens from liver and kidney were collected after kept in formalin then embedded in paraffin 4/6 thin sections were prepared and stained with hematoxylin and eosin according to Carleton, (1978).

### 15. Statistical analysis

Statistical analysis was performed by using computer program COSTATE and compared with each other using the suitable tests (Armitage and Berry, 1987). One way ANOVA was used and results were reported as

1-mean  $\pm$  SD

2- P value differences were considered to be significant

p 0.05 significant; p 0.001 highly significant

### 3. Results and Discussion

#### Effect of lactic acid bacteria on body weight gain, food intake and feed efficiency ratio in rats fed contaminated diet with lead & cadmium mixture:

The obtained data of body weight gain (BWG), food intake (FI) and feed efficiency ratio (FER) in different treatment groups of rats are shown in Table (1). The results demonstrated that group fed on contaminated diet with lead and cadmium mixture showed highly significant decreased ( $p < 0.001$ ) on BWG, FI, and FER as compared to basal diet. The affected body weight by lead and cadmium is similar to those reported by Mahaffey *et al.*, (1981) who showed that cadmium and lead administered in combination may depress weight gain more than either metal alone. However the results illustrated health benefits and the efficiency of lactic acid bacteria strains *Streptococcus thermophilus* and

*Lactobacillus bulgaricus* against toxicity induced by lead and cadmium mixture.

**Table (1): Effect of lactic acid bacteria on body weight gain (gm), food intake (g) and feed efficiency ratio in rats fed lead and cadmium mixture contaminated diet.**

Group \ Parameter	Body Weight Gain (g)	Food Intake (g)	Feed efficiency Ratio
Negative control	24.61 <sup>a</sup> ± 4.46	455.16 <sup>b</sup> ± 27.8	0.05 <sup>a</sup> ± 0.01
Negative control +St1	21.39 <sup>a</sup> ± 7.4	453.33 <sup>b</sup> ± 21.34	0.04 <sup>a</sup> ± 0.01
Negative control +St2	20.04 <sup>a</sup> ± 4.5	455.66 <sup>b</sup> ± 6.31	0.03 <sup>a</sup> ± 0.004
positive control	-13.56 ± 6.36	241.16 <sup>c</sup> ± 9.41	-0.15 <sup>b</sup> ± 0.02
positive control +St1	8.34 <sup>c</sup> ± 1.73	365.83 <sup>a</sup> ± 22.26	0.02 <sup>a</sup> ± 0.005
positive control +St2	12.23 <sup>c</sup> ± 15.62	371.5 <sup>a</sup> ± 10.41	0.05 <sup>a</sup> ± 0.07
LSD	6.05	30.57	0.01
P value	0.05	0.05	0.05

\*Values are expressed as mean ± SD (P = 0.05). Different superscripts are indicating significant between the mentioned values within formula groups.

Negative control = group fed on basal diet

Positive control = group fed on lead & cadmium mixture contaminated diet

ST1 (*Streptococcus thermophilus*). ST2 (*Lactobacillus bulgaricus*).

In the same row different letters means significant variation

#### Effect of lactic acid bacteria on liver functions in rats fed lead and cadmium contaminated diet:

The results in Fig1 demonstrate the effect of different treatments on some serum liver function enzymes alanine aminotransferase (AST) and aspartate aminotransferase (ALT). Positive control showed significant increased (p< 0.05) in enzyme activities as compared to negative control. The affected liver functions by lead and cadmium is similar to those reported by Sauer *et al.*, (1997), they found that the damage effect of cadmium on the liver is manifested by an increased of AST and of the most specific marker of liver cell damage ALT. Also, agree with Othman *et al.*, (2004) who found significantly increased in activities of ALP, AST and ALP of lead treated rats and with Al-Wabel *et al.*, (2007) who showed a significant increased in the activities of ALT and AST in serum of rats received lead acetate compared with the negative control. On the other hand the intake lactic acid bacteria strain1 (*Streptococcus thermophilus*) and strain 2 (*Lactobacillus bulgaricus*) significantly alleviated the elevation of enzyme activity (P = 0.05) in Pb and Cd mixture -treated rats. Also AST and ALT levels of

lactic acid bacteria strain1 and 2 supplemented to basal diet were around control negative.

#### Effect of lactic acid bacteria on glutathione peroxidase activity in rats fed heavy metals contaminated diet:

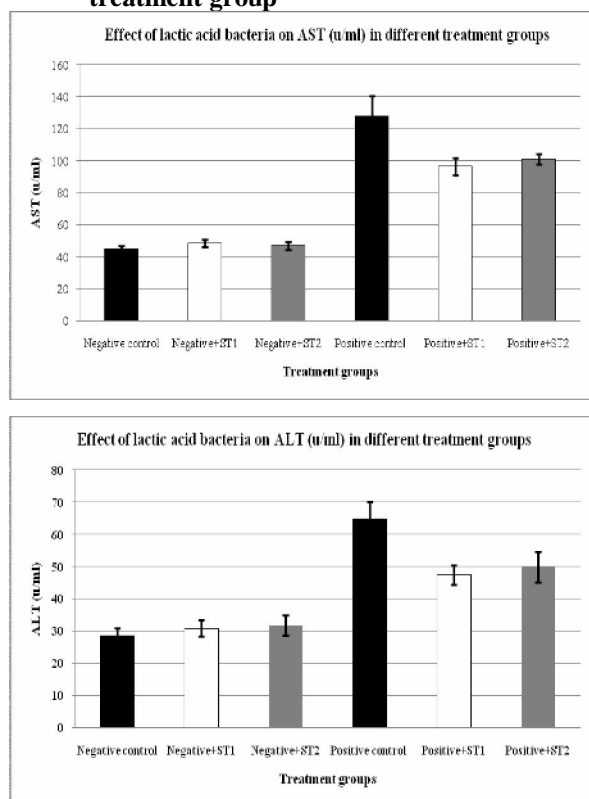
As shown in Fig 2, heavy metals treatment was highly significant depleted glutathione peroxidase (GPX) activity (used as marker of oxidative stress in liver) as compared to negative control (p = 0.001). The depletion of GPX activity was observed by Amara *et al.*, (2008). They found that cadmium exposure significantly decreased the GPx. The decrease in GPX due to Pb and Cd treatment was significantly reduced (p = 0.05) when diet supplemented with strain1 (*Streptococcus thermophilus*) and strain2 (*Lactobacillus bulgaricus*), the former strain was better than the later.

#### Effect of lactic acid bacteria on kidney functions in rats fed heavy metals contaminated diet:

As shown in Fig 3, the effect of different treatments on some kidney function test (urea and creatinine) were investigated. There was high significant increased in urea and creatinine of positive control as compared to negative control

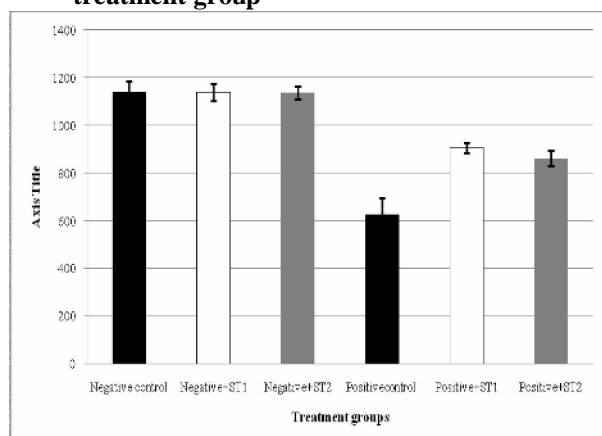
which improved after adding lactic acid bacteria *streptococcus thermophilus* and *Lactobacillus bulgaricus* to Pd and Cd contaminated diet.

**Fig (1). Effect of lactic acid bacteria on liver function (AST & ALT) in different treatment group**



ST1 (*streptococcus thermophilus*).  
ST2 (*Lactobacillus bulgaricus*).

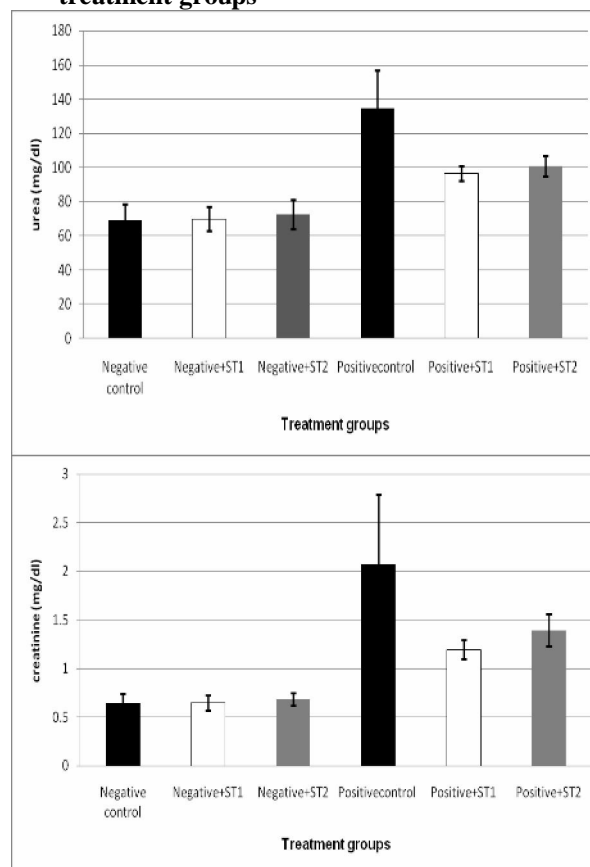
**Fig (2). Effect of lactic acid bacteria on Glutathione Peroxidase (GPX) in different treatment group**



The toxicity of lead and cadmium on kidney functions in agree with Fels *et al.*, (1998) who found

that kidney function can be comprised due to chronic lead exposure. This may account for the increased of urea concentration in the animals received cadmium chloride. Also dietary exposure to cadmium has been reported to cause adverse health effects in the kidneys, liver, bone, peripheral vascular tissues, mammary gland, placenta, prostate, breast, pancreas and colon (Satarug and Moore 2004 and Satarug *et al.*, 2006). In addition Haouema *et al.*, (2007) reported that there are increased in urea and creatinine levels in groups fed on contaminated diet with cadmium and lead, also Adeyemi *et al.*, (2009) concluded that lead contaminated water can possibly cause renal dysfunction as portrayed by the elevated serum concentration of urea and creatinine. Moreover Al-Hashem *et al.*, (2009) found that highly significant increased in serum urea concentration through the experimental period of rats under administration of cadmium chloride compared with the control group.

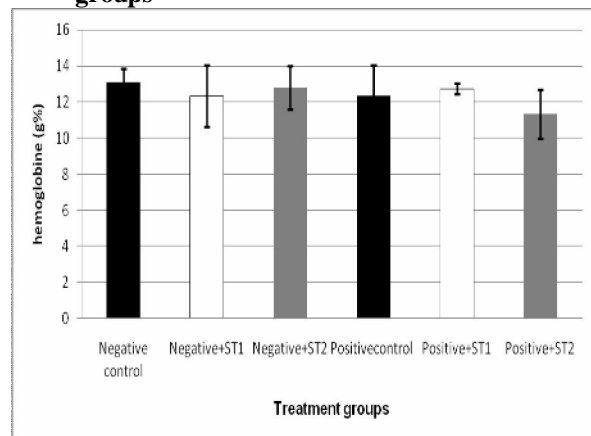
**Fig (3). Effect of lactic acid bacteria on kidney function (urea & creatinine) in different treatment groups**



**Effect of lactic acid bacteria on blood hemoglobin in rats fed heavy metals contaminated diet:**

As shown in Fig 4, level of blood hemoglobin was significant ( $p < 0.05$ ) decreased in positive control as compared to negative control. These results indicated that, anemia caused by lead and cadmium mixture. The decreased in blood hemoglobin was significantly ( $p < 0.05$ ) improved by strain1 (*Streptococcus thermophilus*) and strain2 (*Lactobacillus bulgaricus*) supplemented to lead and cadmium mixture treated group. The results are agree with those reported by (Piomelli *et al.*, 1980) who concluded that Pb effects heme synthesis primarily by the inhibition of the  $\delta$ -aminolevulinic acid dehydrase (ALAD) and the enzyme synthesis (ferrochelatase) controlling the incorporation of an iron in to the heme molecule resulting in an iron deficiency anemia. Moreover Al-Hashem *et al.*, (2009) found that exposure of rats to cadmium chloride resulted in highly significant decreased in blood hemoglobin levels compared with its levels in control group.

**Fig (4). Effect of lactic acid bacteria on blood hemoglobin (g%) in different treatment groups**

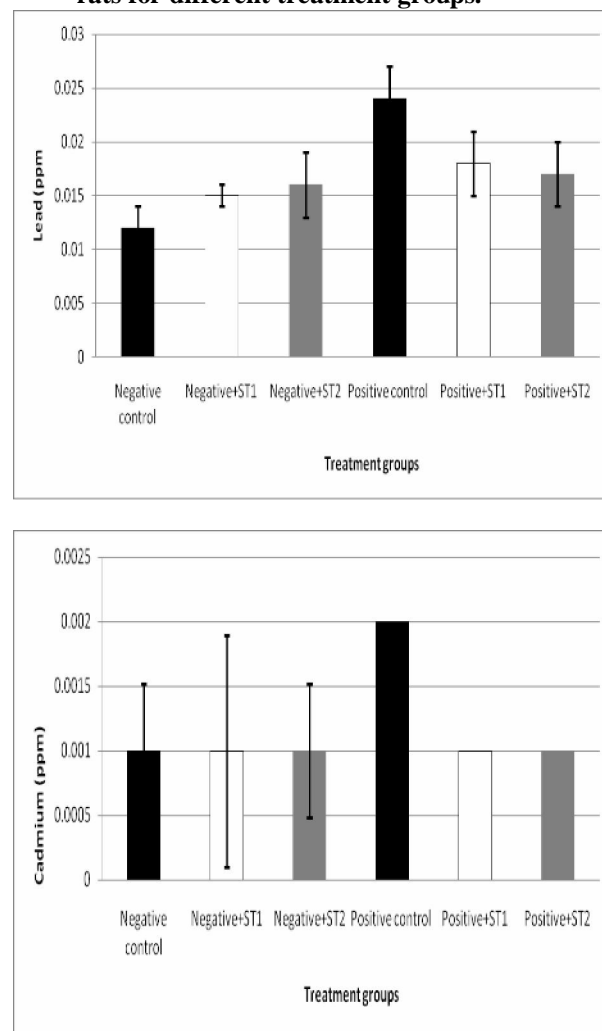


#### Effect of lactic acid bacteria on heavy metals level in blood of rats fed heavy metals contaminated diet:

The results in Fig 5 illustrated the effect of different treatment on lead and cadmium levels in blood of rats after exposure to Pb and Cd mixture. There was significant ( $p < 0.05$ ) increased in positive control as compared to negative control. And significantly ( $p < 0.05$ ) decrease in the groups received lead and cadmium plus lactic acid bacteria strain1 (*Streptococcus thermophilus*) and strain 2 (*Lactobacillus bulgaricus*) as compared to positive control. Groups received lactic acid bacteria strain1 and strain 2 gave concentrations around negative control. The presence of low levels of lead and cadmium in negative control and basal diet supplemented with lactic acid bacteria may be

attributed to their level in drinking water. In general, natural concentration of cadmium and lead rarely exceed the guideline values of 3 and 10 $\mu$ g/L, respectively (WHO, 2006). The improved in heavy metal blood levels after adding lactic acid bacteria may be due to their ability to bind with lead and cadmium; this agrees with Rowland and Gangolli, (1999) who concluded that there was some experimental evidence that administered LAB decreased the amount of administered carcinogens reaching the blood in rats.

**Fig (5). Levels of lead and cadmium in blood of rats for different treatment groups.**

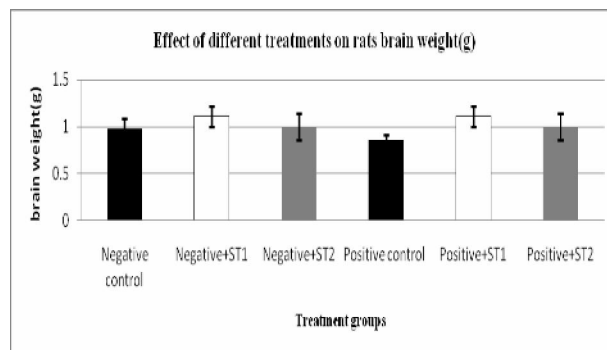
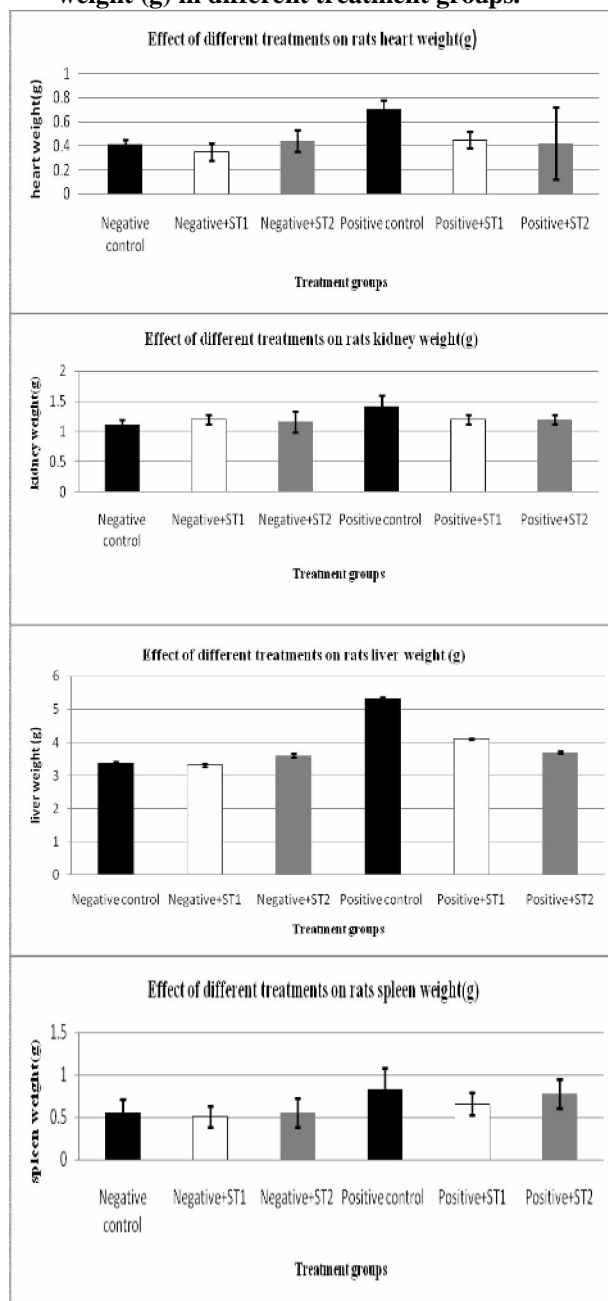


#### Effect of lactic acid bacteria on organs weight of rats fed heavy metals contaminated diet:

Data in Fig 6 showed the effect of tested lactic acid bacteria on organs weight (heart, kidney, liver, spleen and brain) for all treatments. It could be noticed that the group received contaminated diet with Cd and Pb mixture showed significantly

increased ( $p < 0.05$ ) in organs weight as compared to basal diet group. The intake of lactic acid bacteria showed significantly lower ( $p < 0.05$ ) and improved organs weight in heavy treated rats as compared to positive control. Simonyte *et al.*, (2006) found that a long term exposure to heavy metals there was a significant increased in spleen and liver weight.

**Fig (6). Effect of lactic acid bacteria on organs weight (g) in different treatment groups.**



## Results of Histopathology:

### 1. Kidneys.

Kidneys of rat from group 1 which was fed on basal diet for 6 weeks showed no histopathological changes (photo1). Examined sections from group 2 which was fed on contaminated food with 0.025mg lead acetate and 0.025mg cadmium chloride /Kg diet for 6 weeks revealed focal interstitial nephritis associated with cystic dilatation of renal tubules (photo 2). However, kidneys of rats from groups 5 which was fed on contaminated food with 0.025mg lead acetate and 0.025mg cadmium chloride /Kg diet for 6 weeks + strain 1 (*streptococcus thermophilus*) and group 6 which was fed on contaminated food with 0.025mg lead acetate +0.025mg cadmium chloride /Kg diet for 6 weeks + strain 2 (*Lactobacillus bulgaricus*), showed no histopathological changes (photos 3 and 4).

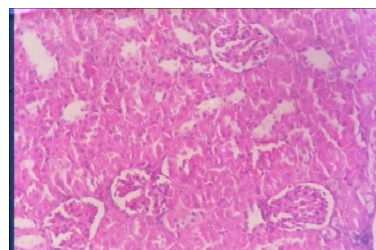


Photo (1). kidney of rat from group 1 showed no histopathological changes

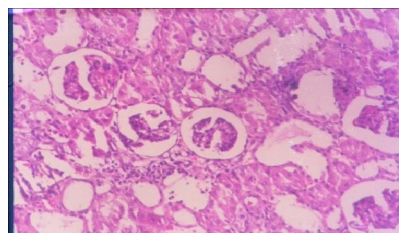


Photo (2). kidney of rat from group 2 showed focal interstitial nephritis associated with cystic dilatation of renal tubules.



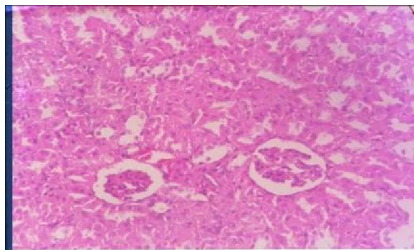


Photo (3). kidney of rat from group 5 showed no histopathological changes.

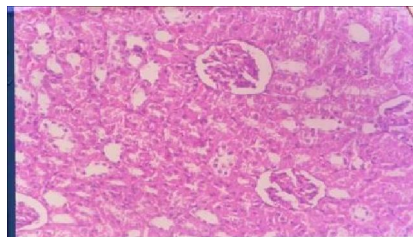


Photo (4). kidney of rat from group 6 showed no histopathological changes

## 2. Liver

Liver of rat from group 1 which was fed on basal diet for 6 weeks revealed the normal histological structure of hepatic lobule (Photo 5). Mean while, liver of rat from group 2 which was fed on contaminated food with 0.025mg lead acetate + 0.025mg cadmium chloride /Kg diet for 6 weeks showed vacuolation of Centro lobular hepatocytes and fibrosis in the portal triad (Photo 6). Slight congestion of central vein was the only change observed in liver of rat from group 5 which was fed on contaminated food with 0.025mg lead acetate + 0.025mg cadmium chloride /Kg diet for 6 weeks + lactic acid bacteria strain 1 (*streptococcus thermophilus*) and some examined sections from group 6 which was fed on contaminated food with 0.025mg lead acetate + 0.025mg cadmium chloride /Kg diet for 6 weeks + lactic acid bacteria strain 2 (*Lactobacillus bulgaricus*) (Photos 7 and 8). Other sections from group 6 revealed no histopathological changes (Photo 9).

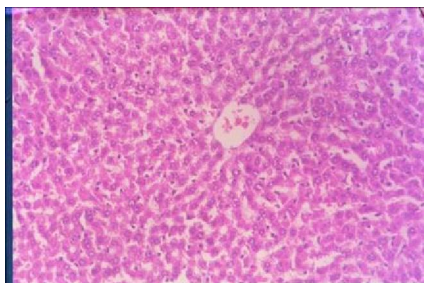


Photo (5). liver of rat from group 1 showed the normal histological structure of hepatic lobule.

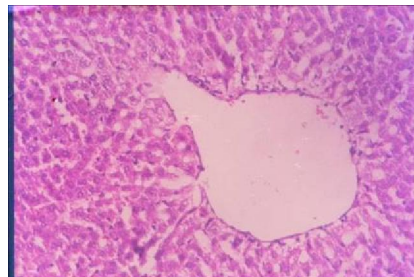


Photo (6). liver of rat from group 2 showed vacuolation of Centro lobular hepatocyte.

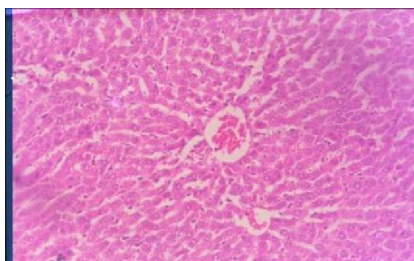


Photo (7). Liver of rat from group 5 showed no histopathological changes except slight congestion of central vein



Photo (8). Liver of rat from group 6 showed no histopathological changes except slight congestion of central vein



Photo (9). Liver of rat from group 6 showed no histopathological changes.

## 3. Brain

Brain of rat from group 1 which was fed on basal diet for 6 weeks revealed no histopathological changes (Photo 10). Meanwhile, brain of rat from group 2 which was fed on contaminated food with 0.025mg lead acetate + 0.025mg cadmium chloride /Kg diet for 6 weeks showed pylenosis of neurons (Photo 11), focal cerebral hemorrhage and necrosis of

purkinge cells of cerebellum (Photos 12 and 13). No histopathological changes except Pylenosis of neurons was noticed in brain of rats from G5 which was fed on contaminated food with 0.025mg lead acetate + 0.025mg cadmium chloride /Kg diet for 6 weeks + lactic acid bacteria strain 1 (*streptococcus thermophilus*) (Photo 14). However, brain of rat from group 6 which was fed on contaminated food with 0.025mg lead acetate + 0.025mg cadmium chloride /Kg diet for 6 weeks + lactic acid bacteria strain 2 (*Lactobacillus bulgaricus*) revealed no histopathological changes (Photo 15).

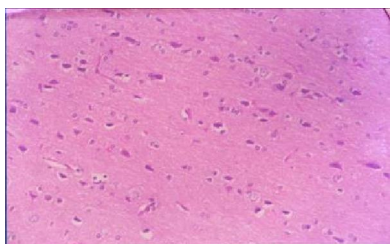


Photo (10). Brain of rat from group 1 showed no histopathological changes.

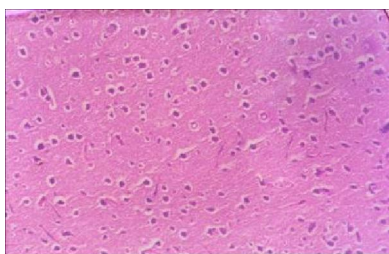


Photo (11). Brain of rat from group 2 showed pylenosis of neurons.

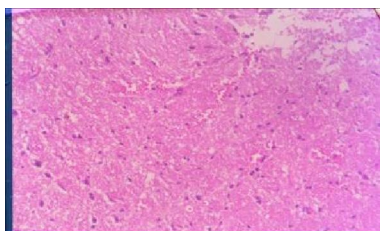


Photo (12). Brain of rat from group 2 showed focal cerebral hemorrhage .

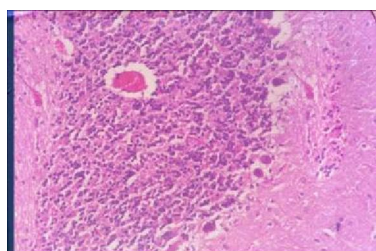


Photo (13). Brain of rat from group 2 showed necrosis of purkinge cells of cerebellum.

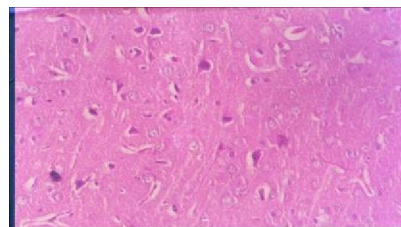


Photo (14). Brain of rat from group 5 showed no histopathological except pylenosis of some neurons.

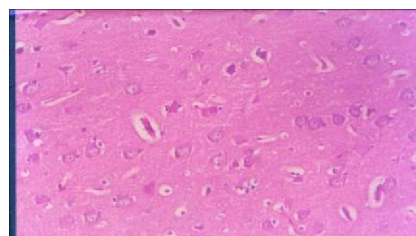


Photo (15). Brain of rat from group 6 showed no histopathological changes.

The results of histopathology obtained indicated that tested LAB strains have an effective role against the toxicity induced by contamination with lead and cadmium. The results illustrated that examined section for negative control showed no histopathological alternation. Meanwhile rats fed on contaminated diet showed marked focal interstitial nephritis associated with cytic dilatation of renal tubules in kidney and vacuolation of centro lobular hepatocyte and fibrosis in the portal triad in liver also pylenosis of neurons and necrosis of purkinge cells of cerebellum in brain. These results are agreed with El-Sokkary *et al.*, (2005) who found severe histopathological damage in liver and kidney in lead-treated rats. Also Koyu *et al.*, (2006) evaluated histipathologic changes included vacuolar and granular degeneration in hepatocytes, heterochromatic nucleuses and sinusoidal and portal widening in liver of rats treated with Cd. However the intake of strain1 (*Streptococcus thermophilus*) and strain2 (*Lactobacillus bulgaricus*) in the liver sections and showed no histopathological changes in kidneys also showed improved in the brain section in liver treated heavy metals.

It could be concluded that protective action of lactic acid bacteria strains especially the strains *streptococcus thermophilus* and *Lactobacillus bulgaricus* as a potential protective agent against lead and cadmium toxicity as well as their beneficial health effects this may be due to the ability to bind with lead and cadmium and remove the toxicity of lead and cadmium on rats. Numerous investigations indicated that LAB have beneficial health effects and thought to have several presumably beneficial effects on immune function (Ouwehand *et al.*, 2002; Reid *et*



*al.*, 2003 and Saxelin *et al.*, 2005). Heavy metals have been reported to passively bind to the bacterial surface of LAB by electrostatic interactions (Haskard *et al.*, 2000). Also Halttunen, (2007) found that Cd and Pb binding by lyophilized lactic acid bacteria and bifidobacteria. In addition, Teemu, *et al.*, (2008) concluded that specific lactic acid bacteria were observed to have a strain-specific capacity to bind the toxic cationic heavy metals, cadmium and lead, from water.

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**Deterioration of Rock Art Painting at unfinished obelisk quarry in Aswan****Shehata Ahmed Abdel Rahim <sup>\*1</sup> and Hesham Abbas Kamally<sup>2</sup>**<sup>1</sup>Conservation and Restoration Department, Faculty of Archeology, Fayoum University, Egypt<sup>2</sup>Restoration Department, High Institute of Tourism, Hotel Management and Restoration, Alexandria, Egypt<sup>\*</sup>[shehataaa@yahoo.com](mailto:shehataaa@yahoo.com)

**Abstract:** The famous unfinished obelisk quarry, southeast of Aswan is a unique source of large granite monuments. The area of the northern obelisk quarry has been recently excavated and renovated by Supreme Council of Antiquities, a huge mounds of rubble, sand and granite powder cleared to reveal many unknown granite objects, unfinished statues and several quarry tools. After the workers cleaning the sand and dirt from the quarry walls, they found that the quarry faces covered with striking scenes. The first feature, a group of Ostriches, different in body size walking in the desert with red ochre. The second feature fishes swimming in water have fins and use gills for breathing underwater and several boats or cargo boats with black ochre. Moreover, a large obelisk with red ochre present between the swimming fishes distinctly different in body size. The present paper is an attempt to elucidate the weathering, geological and structural characteristics of granite rocks. This paper also aims to identify and understand the causes and mechanisms of deterioration of the wall paintings in the unfinished obelisk quarry. Exposure to wind, rain, fluctuation of temperature, groundwater, seepage, moisture, biological growth and encrustation, all contribute to the deterioration of the rock art in the quarry. Salt effloresces, granular disintegration and the enlargement of existing granite pores and cracks close to the rock surface, facilitate and accelerating the rate of weathering. Unfortunately, even slow rates of weathering can lead to unacceptable deterioration of rock paintings, as the painting layer on the granite surface are friable and cannot persist on a disaggregating or flaking granite surfaces. Several samples has been examined by petrographic microscope, X- ray diffraction analysis (XRD) and scanning electron microscope (SEM) showed that the products of the highly weathered pink granite are dominated by kaolinite, iron oxides, calcite and muscovite.

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<http://www.americanscience.org>.

**Key words** Rock painting, granite weathering, unfinished obelisk quarry, red painting, black painting

**1. Introduction:**

The unfinished obelisk quarry is located in the southern part of Aswan, less than one Kilometer east of the road to the High Dam. It is an ancient quarry where wedge – holes made by the ancient quarrymen. They are can be seen beside remains of a huge, undetached block of granite (unfinished obelisk) 41.75 meters long and 4.2 meters wide at its broader end Fig. (1-A). The early peak of granite quarrying was reached during the old kingdom, when 45,000 cubic meters of stone were removed from the quarries of Aswan (Roder, 1965). The granite rocks are generally not homogenous in mineralogical composition. The unfinished obelisk quarry in Aswan contains excellent granite rocks which are hard, compact and free from many foreign xenoliths (Ball 1907). They acquire beautiful colours ranging from pink to worm red and dark red (Barthoux 1922; Hume 1935; Gindy 1974; Meneisy *et al.*, 1979). The Aswan monumental granite is dissected by large, extensive and widely spaced joints with a distance separating the joints reaching about 5 meters. It was selected by the ancient Egyptians as a sole source of

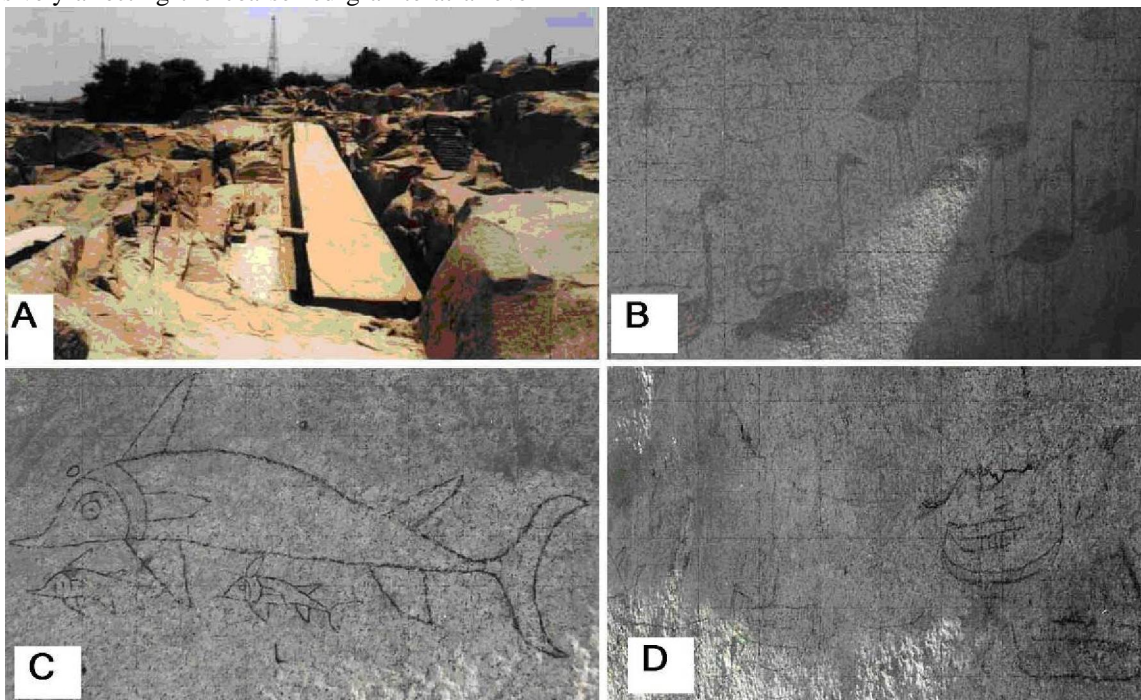
the larger obelisks and many ornamental structures from the ancient time (Gindy 1956). Egyptian rock art is known in many sites in upper Egypt, Nubian Nile valley, Eastern and Western desert. Rock art is a term normally applied to paintings and engravings on natural rock surface (Coulson & Campbell, 2001). Walls of unfinished obelisk quarry were covered with striking scenes. A group of Ostriches, different in body size walking in the desert with red pigment Fig. (1-B). In Fig. (1-C) there is a scene of fishes swimming in water. Several boats with black pigment Fig. (1-D). The rock art of unfinished obelisk quarry made of two pigments red and black.

Cause of rock paintings deterioration has been argued (Bradley *et al.*, 2002). The weathering of the rock surface is rather than alteration of rock paintings, through a variety of mechanisms, (Van Rijssen, 1987). The degree of adhesion of a painting to the rock surface will depend on the nature of the rock, pigment, its binder and the method of application (Batchelor, 1990; Loubser, 1991). Dry pigments and those applied as a past are easily peeled off and deteriorate rapidly, whereas those that are



more fluid are able to infiltrate deeper into the rock making them more resilient (Loubser, 1991). The disintegration of granite rocks in Aswan region seems to belong two periods other than present. The products of what seem to be the earliest period of disintegration are found at the contact of coarse red granite with the base of the overlying Nubian sandstone. They form a zone of what Ball designates as "broken - down granite, a kaolinic mass with quartz grains". The second period is manifested in a tendency toward deep, granular disintegration massively affecting the coarse red granite at a level

which is approximately that of the Aswan Reservoir when full. This disintegration is best seen on the island of El Hesa (Barton, 1916). Weathering processes are influenced by endogenetic and exogenetic factors, whereby endogenetic factors are related to the structure and composition of the rock itself, and exogenetic factors include climate and vegetation. The mechanisms which contribute to the deterioration of granite can be grouped into three separate categories: mechanical, chemical and biological (Small and Clark, 1982; Viles, 1995).



**Fig. (1A):** The famous unfinished obelisk at the obelisk quarry in Aswan. **(B)** Group of Ostriches, different in body size walking in the desert with red pigment. **(C)** Fishes swimming in water. **(D)** Boats with black pigment.

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The change of temperature in Egypt especially in the southern places affects these granite rocks very much in a way that leads to a disintegration of grain intergrowth forces and separation of some of these grains (Helmi, 1985). A more probable cause of this type of degradation is the infiltration of soluble salts into the rock pores and crystallization of the salts there in. Voute (1963) ascribed the damage within the granite of Aswan to soluble salts. Also, Edmond *et al.* (1979) considered the process of weathering of igneous rock as a combination of hydrolysis reaction and acid attack by  $\text{CO}_2$  – charged rain and groundwater. The changes produced by weathering in fresh rocks are governed by thermodynamic laws and can be ascribed to partial or complete decomposition of both major and minor chemical elements (Carrol, 1970). Chemical weathering of rocks is one of the major processes that modify the earth's surface contributing to the geochemical cycling of elements. (Casellato *et al.*, 2000) argue that conservation intervention can be more appropriate when “...quantitative physico-chemical properties of the object are sufficiently known” as this helps elucidate the modification the object has undergone as a result of “...the action of time, weather and human beings.” Once we better understand the chemical composition so we may better understand the performance properties of the pigments (Hao and Iqbal, 1997)

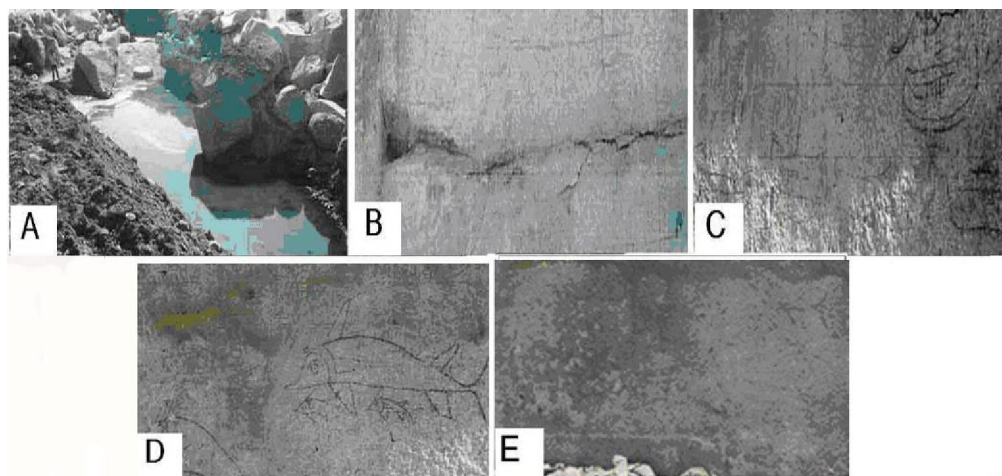
## 2. Materials and Methods:

Samples of the granite rocks, altered granite surfaces, and consolidate granite flakes were studied by Polarizing microscopy (PLM), scanning electron microscope SEM-EDX and X-ray diffraction (XRD) to find their mineral composition, morphological features and alteration products of granite rocks and paintings in the obelisk quarry.

## 3. Results and Discussion:

### Field observation

During a field visit, a complete survey carried out by field observation, visual inspection at the unfinished obelisk quarry explained many different deterioration factors are affecting on granite rocks and paintings in the obelisk quarry as solar radiation, structural changes, moisture, ground and underground water leading to fracturing, crumbling, discoloration and exfoliation of rock surfaces (Meiklejohn, 1995). There are many deterioration aspects Fig. 2(A-E) as underground water appeared during the recent excavation, cracking, loosening and detachment of some rock art details due to internal pressures and intensive strains (as a result of salt crystals and thermophysical action) and brown, yellow and black colors due to inappropriate previous treatment represented in consolidation processes with a solution of paraloid B-72 in acetone solvent.



**Fig.(2) Deterioration aspects of unfinished obelisk quarry.(A) Underground water during the recent excavation. (B) Cracking, loosening and detachment of some rock art details due to internal pressures and intensive strains. (C, D, E) Brown, yellow and black colors due to inappropriate previous treatment**

### Polarizing Microscope (PL)

The examination of the granite samples thin section under polarized light microscope displayed that the granite rock composed mainly of alkali feldspars, quartz, plagioclase and biotite, together with variable amounts of hornblende. Zircon, iron

oxides, sphene and apatite are accessory minerals. Microcline appeared as subhedral to anhedral crystals, characterised by cross hatch twinning. It is slightly kaolinitized, commonly replaced by sericite, calcite and muscovite shreds. It commonly encloses fine quartz crystals replaced with biotite flakes and



hornblende relics that pass into microcline crystal which causes instability of the microcline crystals Fig.(3-A). Microcline perthite forms subhedral to anhedral phenocrysts with irregular boundary, slightly turbid, mostly cracked, completely altered and highly sericitized and kaolinitized which make them more prone to deterioration by natural rock weathering processes Fig.(3-B). It encloses subrounded quartz crystals and relics of altered plagioclase. Irregular granules and fine dust of iron oxides concentrated along the cleavage planes. Perthite is of the vein flame and patchy types Quartz forms interlocking anhedral crystals filling the interstices between the feldspars. These crystals are highly intensely strained, cracked and exhibit wavy extinction. It is enclosed commonly in alkali feldspars, plagioclase and biotite and the calcite veinlets dissecting the quartz crystals as a result of alteration processes Fig. (3-C). The existence of calcite is essential in understanding the nature of chemical weathering of the granite rocks.

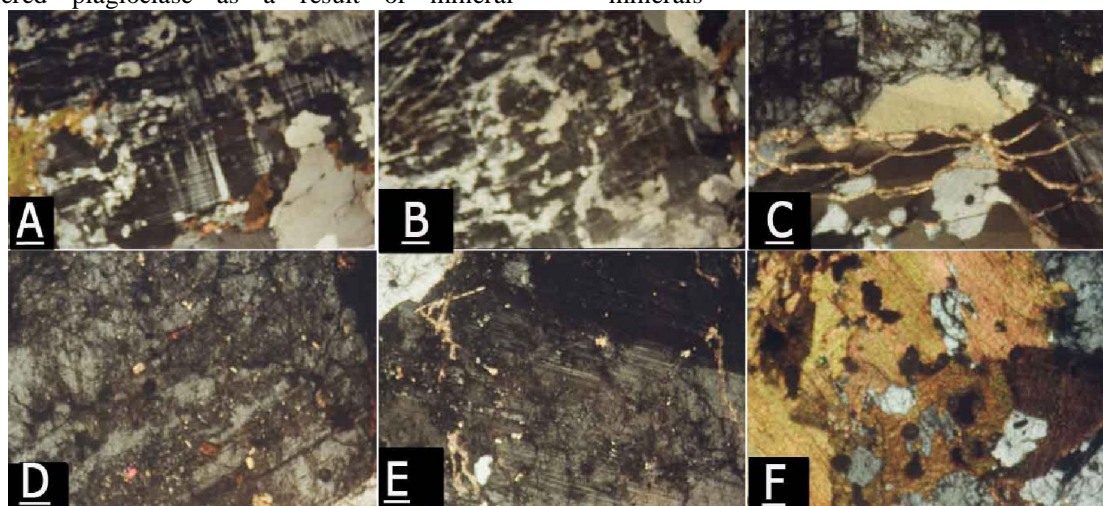
Plagioclase occurs as subhedral to anhedral crystals, turbid, cracked, slightly kaolinitized. In Fig. (3-D) plagioclase commonly stained by hematite dust and enclosed with iron oxides granules, epidote, sericite, kaolinite. Iron oxides are commonly concentrated along the borders and cleavage planes. Some weathered plagioclase crystal stained by hematite dust and gives brown pigmentation due to the intensive alteration. Numerous points of sericite, epidote and scaly or tiny muscovite flakes (secondary minerals) disseminated throughout the highly weathered plagioclase as a result of mineral

transformation through the alteration processes. Sometimes the weathered plagioclase crystal replaced by calcite veins (Keller 1976) Fig.(3-E), intensely strained where the twin lamellar are bent, microfaulted and occasionally absent. Biotite occurs as subhedral to anhedral flakes of brown colour and strongly pleochroic from straw yellow to dark brown. Commonly biotite flakes altered along cleavage planes to sphene, epidote and brown iron oxides. It is frequently enclosed irregular granules of iron oxides Fig. (3-F). The alteration products of mafic minerals such as biotite and hornblende are hematite, supplies the typical reddish and chocolate brown colours of altered granite rocks.

Hornblende forms anhedral crystals of green colour and strong pleochroism form pale green to dark green or olive, green. It is frequently replaced by anhedral biotite flakes dispersed within it. Numerous It encloses irregular granules of iron oxides and hematite dust concentrated at the cleavage planes.

Epidot occurs as subhedral crystal and commonly associated with biotite and plagioclase crystals as shown in Fig.(3-D). Sphene forms subhedral to anhedral crystals with rhombic outline and commonly associated with hornblende and biotite.

Keller (1976) stated that the micropitting of feldspar, probably as a result of dissolution of feldspar crystals (transformation minerals) and the early stage of kaolinization. Weathering processes that are possibly to be active at these borders consist of salt crystallization, hydration and dehydration of minerals, salts hydration and dehydration of clay minerals



**Fig.(3):** The examination of the granite samples thin section under cross polarised microscope.(A) Microcline crystal slightly sericitized, encloses fine quartz crystals and replaced with hornblende and biotite flakes. (B) Microcline perthite turbid, mostly cracked, completely altered. (C) Calcite veinlets dissecting the quartz crystals. (D) Plagioclase enclosed with iron oxides granules, epidote and sericite and (E) replaced by calcite veins. (F) Biotite flakes altered and enclosed irregular granules of iron oxides.

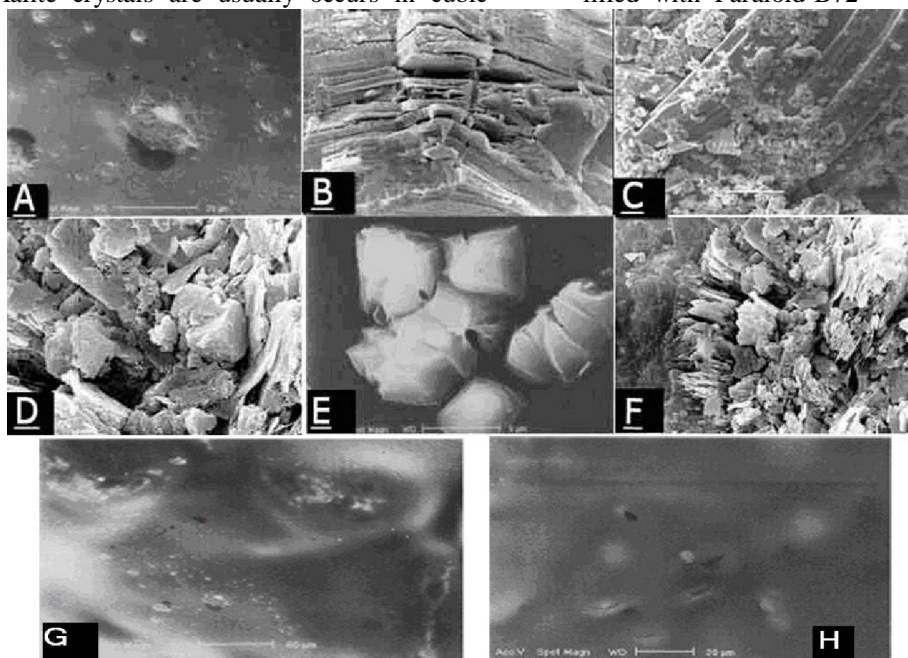
### Scanning electron microscope (SEM)

Scanning electron microscope examination micrographs of external deteriorated granite surfaces from the unfinished obelisk quarry showing that the weathered granite surfaces is porous, has many salt crystals, pits, black spots and scales as a result of physical and chemical alteration Fig. (4-A).

Formation of sheeting structure and the enlargement of existing granite cleavages close to the surface of granite, facilitate an increasingly dynamic moisture regime which leads to accelerate the rate of deterioration. Macro and micro cracks and incipient joints present lines of weakness along which individual mineral crystals or particles may disintegrate and exfoliation may occur as shown in Fig. (4-B).

The SEM micrographs showing that the typical degradation forms in granite rock consist of fissures, sheets and scales of several sizes. Paraloid-B72 is able to penetrate through these fissures and sheets where it builds up some adhering bridges between the fracture walls and sheeting structure. One of the most important weathering process at the unfinished obelisk quarry is the salt efflorescences which cover the tope surface of paintings rock and growth of salt crystals within the porous and microcracks of the granite rocks (Hugget, 2003) Fig. (4-C). Halite crystals are usually occurs in cubic

form, produce a kind of vuggy pockets Fig. (4-D). Moreover, epsomite crystals commonly occur as rhombic shape as a result of pollution, ground and underground water Fig. (4-E). The salt crystals precipitate in the porous and microcracks can exert stress and readily cause mineral breakdown. The final results is either crumbling of the thin surface layer or forming a blister and exfoliation on the surface of rock art. The hydration of salts within pores and cracks develops sufficient stress to cause extensive sapling and flaking. Weathering is very intense along fractures and the spatial variation of weathering is connected with the structure and texture of granitic rocks (Ritter *et al.* 1995). Kaolinite was identified by SEM micrographs from crystal habit (forming booklets) as a result of feldspar alteration by hydrolysis process Fig. (4-F). In addition, SEM micrographs revealing that there are large islands on the treated surfaces surrounded by rims and sometimes the rims disappear but the island area are still visible as a result of inappropriate solvent used for Paraloid-B72 film preparation Fig. (4-G). On the otherside, the treated granite samples revealed that the surface of rock art have a high density distribution of Paraloid-B72, relatively with smooth surface and sometimes with slightly rippled surface, the pores at the surface relatively are completely filled with Paraloid-B72 Fig.(4-H).



**Fig.(4) The SEM micrographs of external deteriorated granite surfaces (paintings rock). (A) Granite surface has many salt crystals, pits, scales and black spots. (B) Exfoliation phenomenon in the granite surfaces. (C) Salt crystals cover the tope surface of paintings rock. (D) Halite crystals occur in cubic form. (E) Epsomite crystals occur in rhombic shape. (F) Kaolinite booklets due to alteration of feldspars. (G) Large islands surrounded by rims on the treated granite surfaces as a result of inappropriate solvent. (H) The distribution of Paraloid-B72on granite surfaces, relatively with smooth surface and sometimes slightly rippled surface.**

### X- Ray Diffraction analysis (XRD)

Three samples taken from damage surfaces collected from rock art site have been examined by X-ray diffraction analysis (XRD) at the Scientific Mobark City to find their mineralogical characteristics and the alteration products of pigments and granite rocks. Pigment paints lie directly on the granite rocks and that paintings is exposed to solar

radiation, therefore there will be thermal differences between the pigments and the granite rock due to differential and thermal properties. Moreover, changes in environmental conditions of moisture and temperature are suggested to effect the stability of pigments of rock art. Accordingly, pigments are easily washed away or simply fade through natural weathering (Fleisher *et al.*, 2005).

**Table (1): Results of X – ray diffraction analysis**

Sample No.	Material type	Sample site	Composition
1	Altered granite surface	Obelisk quarry wall	Quartz – Microcline – Albite – Epsomite – Epidote -Bayerite-
2	Red pigment	Paintings rock in obelisk quarry	Hematite - Quartz – Microcline – Albite
3	Black pigment	Paintings rock in obelisk quarry	Graphite – Nontronite – Iron oxide

The results of the study ( Table 1 ) have shown that the altered granite sample from the obelisk quarry wall consists of quartz (  $\text{SiO}_2$  ), microcline (  $\text{K AL Si}_3\text{O}_8$  ), albite (  $\text{Na AL Si}_3\text{O}_8$  ), epidote  $\text{Ca}_2 \text{Fe}_3 \text{AL}_2\text{O Si}_2\text{O}_7 \text{SiO}_4$  (OH), bayerite  $\text{AL(OH)}_3$ , wustite  $\text{FeO}$  and epsomite  $\text{Mg SO}_4 \cdot 7 \text{H}_2\text{O}$ .

In addition XRD data of red pigment obtained by scraping the surface of paintings rock indicated that the red pigment consists of hematite (  $\text{Fe}_2\text{O}_3$  ), quartz (  $\text{SiO}_2$  ), microcline (  $\text{K AL Si}_3\text{O}_8$  ) and albite (  $\text{Na AL Si}_3\text{O}_8$  ), while the black pigment from the paintings rock consisted essentially of graphite ( C ), nantronite ( Fe, AL )  $\text{Si}_2\text{O}_5$  and iron oxides.

**Table ( 2 ) Results of ( EDX ) Energy Dispersive X-Ray analysis of the altered granite rocks from obelisk quarry.**

Mineral composition	Al	Si	K	Ca	Ti	Mg	Fe	Na
Sample of granite	16.7	46.4	7.3	1.3	2.6	1.2	24.5	0.9

EDX analysis of altered granite from obelisk quarry commonly consisted of Si, Al, K, Ca, Fe, Mg, Ti, and Na. The chemical composition of the altered granite sample relatively enriched in Fe, Ca, K and Al while Si is markedly depleted.

### 4. Conclusion:

Generally, the unfinished obelisk quarry is an archaeological quarry. The area of the northern unfinished obelisk quarry has been recently excavated and cleaning from sand, rubble and granite powder. The quarry has a very interesting paintings rock. The paintings and granite rocks in the unfinished obelisk quarry at Aswan are constantly exposed to many deterioration factors. The weathered granite surfaces were examined by polarizing microscope (PL), scanning electron microscope (SEM), EDX and X-ray diffraction (XRD) analysis. Some painting suffered a total loss of the painting thin layers and in others there is only loss of small parts of the painting layer.

The salt crystallization such as epsomite and halite crystals can cause a significantly degraded by intensive mechanical stresses which produced many

tiny fissures, greatly increase the porosity and detachment many scale from the granite surface. Polarizing microscope examination revealed that the weathered plagioclase crystals dissected along the cleavage planes and boundaries, frequently filled with iron oxides, epidote, sercite and clay minerals. The X-ray diffraction analysis revealed that the red pigment is hematite beside other minerals such as quartz, microcline and albite. The black pigment is carbon compound such as soot, ground charcoal or burnt animal bones.

Field observation and scanning electron microscope revealed that the cleaning and consolidating techniques were not appropriate. A granite rock needs to " breathe " or remain permeable to water vapor and liquid in order to avoid any build up of moisture ( shear stress ) at the interface between the treated zone and the untreated stone below (Fleisher *et al.*, 2005). Granite rock is not uniformly absorptive and it better to apply lower concentration and then coating repeat. SEM micrographs revealed that the Paraloid-B72 film is relatively smooth surface but in some areas show slightly rippled surface. Also, SEM photographs showing large



islands surrounded by a rim and sometimes the rims disappeared but the island area is still visible. The island areas, rough and rippled surface is attributed to the inappropriate solvent which used for film preparation. The altered granite sample enriched in iron oxides, from oxidation weathering of mafic minerals as reflected from the petrographic studied and XRD and EDX analysis. This may suggest extensive invasion of water and exposure to oxidizing.

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## Study Of Peripheral Neuropathy In Chronic Hepatitis C Virus Infected Patients

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**Abstract: Background:** Hepatitis C is a serious worldwide problem, the WHO has estimated that, 170 million people worldwide are infected with hepatitis, while the prevalence in the general population ranges between 0.2 and 2%. **Aim of the work:** to study peripheral neuropathy in patients with chronic hepatitis C virus infection. **Patients and methods:** This study was conducted on forty patients selected from patients Of Tropical Medicine Department in Minoufiya University Hospital suffering from chronic hepatitis C virus infection. They were 23 males and 17 females and their ages were ranging from 28 to 62 years, plus twenty healthy persons of matched age and sex. These patients will be classified into 3 groups: Group (1): Chronic HCV patients without liver cirrhosis, group (2): Chronic HCV patients with liver cirrhosis and group (3): Persons matching for age and sex as a control group. All Patients and control group will be subjected to Thorough history taking, Full clinical examination, Neurological examination, Laboratory investigations: Complete blood count, liver function tests, kidney function tests, random blood glucose level, Viral markers by ELISA, estimation of serum level of vitamin B12, estimation of serum level of cryoglobulins (immunoglobulin (Ig M)) and complement (C3), abdominal ultrasonography and nerve conduction studies. **Results:** peripheral neuropathy was diagnosed by electrophysiological examination in 14 patients (35%) of HCV positive cases and clinical peripheral neuropathy presented in 10 patients (25%). There is significant decrease of the amplitude of the median, ulnar and peroneal nerves in the group of HCV patients with cirrhosis than the control group but not between patients without cirrhosis and the cirrhotic or the control group. Also there was no statistically significant difference between the three studied groups as regard to the conduction velocity and distal latency of median, ulnar and peroneal nerves. Significant increase in serum cryoglobulin in peripheral neuropathy patients as 10 (71.43%) patients having peripheral neuropathy are positive CG. **Conclusion:** PN is present in HCV patients without cirrhosis and become progressively increased in HCV patients with cirrhosis, PN in HCV patients is polyneuropathy and axonal. PN may be clinically diagnosed or diagnosed by electrophysiological examination, Cryoglobulins significantly increased in HCV patients with peripheral neuropathy.

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Keywords : HCV , Cryoglobulin and peripheral neuropathy.

### Introduction:

Hepatitis C virus (HCV) is a parenterally transmitted, hepatotropic and lymphotropic RNA virus, it is a common cause of liver disease and a major health problem worldwide.<sup>1</sup>

Numerous extrahepatic manifestations have been reported in association with hepatitis C virus (HCV) infection including renal disease, lymphoma, Sjögren syndrome, mixed cryoglobulinaemia, Porphyria cutanea tarda and peripheral neuropathy.<sup>2</sup> Most extrahepatic manifestations of chronic HCV infection are immunological and the chronic infection seems to be necessary for their development.<sup>3</sup>

It was generally believed that, hepatitis C virus can damage only liver and blood, however, other studies revealed that, hepatitis C virus also infects neurons and destroy the central nervous system.<sup>4</sup>

It has become clear that, most cases of so-called essential cryoglobulinaemia are in fact associated with HCV infection<sup>5</sup>. *Hepatitis C virus infection causes peripheral neuropathy by performing an immune state*

which can elaborate three types of neuropathies, the first is cryoglobulinaemic neuropathy, the second is Guillain-Barre syndrome and the third is peripheral neuropathy without detectable cryoglobulins. In addition to these; HCV can cause neuropathy indirectly through induction of type 2 diabetes mellitus.<sup>6</sup> Aim of the work: This work aimed to study peripheral neuropathy in patients with chronic hepatitis C virus infection.

### Patients and Methods

This study was conducted on forty patients selected from patients Of Tropical Medicine Department in Minoufiya University Hospital suffering from chronic hepatitis C virus infection in the period from Jan 2007 to March 2008. They were 23 (57.5%) males and 17 (42.5%) females and twenty healthy persons of matched age and

sex. These patients will be classified into 3 groups:

**Group (1)** comprised (20) chronic HCV patients without liver cirrhosis, **group (2)** comprised (20) chronic HCV patients with liver cirrhosis and **group (3):** comprised (20) healthy persons as a control group.

**Exclusion criteria :** (1) Patients with diabetes mellitus, renal failure, vitamin B12 deficiency (2) the presence of other associated conditions that can cause neuropathy e.g. diseases such as, lymphoma and leprosy or medications such as, amiodarone, dapsone and isoniazide. (3) patients infected with hepatitis B virus or positive HIV, (4) patients with intravenous drug abuse and alcoholics, (5) patients already with hepatic coma or precoma and patients with extensive lower limb edema. (6) patients taking interferon therapy. (7) patients refusing to give a written consent,

**All patients and control group were subjected to;** (1) thorough medical history taking with stress on symptoms of chronic hepatic illness such as, fatigue, anorexia, nausea, pruritis, haematemesis, melena and jaundice. (2) general examination with stress on jaundice, ascitis, splenomegally and hepatomegally. (3) Thorough neurological history and examination using standard neurological sheet. (4) laboratory investigations; (a) HCV infection was assessed by ELISA and polymerase chain reaction (PCR), (b) complete blood count; (c) liver function tests (serum bilirubin; ALT, AST, albumin, prothrombin time and concentration), (d) kidney function tests (serum urea and creatinine), (e) random blood glucose level, (f) estimation of serum level of vitamin B12, (g) estimation of serum level of Cryoglobulins IgM and Complement 3 (5) abdominal ultrasound : for diagnosing liver cirrhosis, presence of portal hypertension and presence or absence of ascites (6) nerve conduction study of median, ulnar and peroneal nerves by using NIHON KODEN EMG machine.

**Statistical analysis:** Data was collected and analysed by SPSS version 11. quantitative data were expressed as arithmetic mean, standard deviation, paired t test and kruskal wallis test. qualitative data expressed as frequency and percentage and analysed by chi-square test. Level of significance was set as  $p\text{-value} < 0.05$ .

## Results:

Forty patients of HCV infection studied, they were 23 males and 17 females and their ages were ranging from 28 to 62 years. The mean age was  $47.45 \pm 8.47$  years in group (1) eleven of them were males and  $47.45 \pm 6.19$  years in group (2) twelve were males. the mean age in control group was  $48.5 \pm 8.26$  years and there were no statistically significant difference between the three groups regarding demographic findings. Clinical manifestations of hepatic illness in patients groups include: fatigue, anorexia, dyspepsia, haematemesis,

melena and jaundice. There was highly statistically significant difference between cirrhotic and non cirrhotic patients as regards to these symptoms. table (1) shows clinical, general and abdominal examination in patients groups and shows highly statistically significant difference between both groups regarding manifestations of liver decompensation. As regards ultrasonographic findings, there was statistically significant difference between both groups in splenomegaly: liver size and ascites. Regarding peripheral neuropathy symptoms and signs, there was statistically significant difference between both groups as regards pain, numbness, weakness and superficial sensory loss but no statistically significant difference regarding deep sensory loss and absent tendon reflex. (table 2). laboratory measurements among the studied groups are summarized in table (3). There was statistically significant increase in the serum level of cryoglobulin in group (2) than group (1) and group (3) as positive cryoglobulin (IgM) found in seven patients (35%) of group (2) versus three patients (15%) of group (1) while negative in group (3). Serum level of complement C3 among the studied groups was  $1.39 \pm 0.46$ ,  $1.17 \pm 0.64$  and  $1.72 \pm 0.46$  in the three groups, respectively and there was statistically significant decrease in serum level of complement C3 in group (2) than group (1) and group (3). Tables (4, 5, 6) show median nerve, ulnar nerve and peroneal nerve conduction studies among studied groups, there was statistically significant decrease in the amplitude (motor and sensory) between group 2 and 3 and no statistically significant difference between the studied groups as regards the velocity and latency of the nerves.. peripheral neuropathy was diagnosed in 10 patients (50%) in group (2) of them 8 patients (40%) were symptomatic and 4 patients (20%) in group (1) of them 2 (10%) were symptomatic and this was of highly statistically significant difference. Among all patients of peripheral neuropathy (14 patients in both groups), there was highly statistically significant increase in serum cryoglobulin in peripheral neuropathy patients as 10 (71.43%) patients have positive cryoglobulin and the remaining 4 (28.76%) patients have negative cryoglobulin. Peripheral neuropathy increased significantly with age, the mean age was  $52.21 \pm 7.0$  years in peripheral neuropathy patients and  $44.88 \pm 6.2$  years in patients

without peripheral neuropathy and this was of highly statistically significant difference but not with sex, Also the serum level of Cryoglobulin increased significantly with age, of 10 patients with positive cryoglobulinaemia

the mean age was  $53.1 \pm 6.44$  years while the mean age of 30 patients without cryoglobulinaemia was  $45.57 \pm 6.67$  years but not with sex.

**Table (1) Clinical, general and abdominal examination in G1 and G2 :**

	G1 (n=20)		G2 (n=20)		X <sup>2</sup>	P.value
	No	%	No	%		
Fatigue	4	20	10	50	14.16	< 0.001 **
A norexia	0	0	6	30	13.33	< 0.001 **
Dyspepsia	0	0	10	50	14.16	< 0.001 **
Haematemesis	0	0	6	30	13.33	< 0.001 **
Melena	0	0	6	30	13.33	< 0.001 **
jaundice	0	0	11	55	26.94	< 0.001 **
encephalopathy	0	0	0	0	----	----
Spider naevi	0	0	3	15	6.32	< 0.05 *
Palmer erythema	0	0	6	30	13.33	< 0.001 **
LL oedema	0	0	11	65	33.91	< 0.001 **
Flapping tremors	0	0	0	0	----	----
Petechial Haemorrhage	1	5	9	45	17.52	< 0.001 **
Splenomegally	3	15	7	35	8.13	< 0.05 *
Shrunken liver	0	0	15	75	24	< 0.001 **
Hepatomegaly	7	35	5	25	0.48	> 0.05
Ascites : No	20	0	2	10	33.19	< 0.001 **
Mild	0	0	10	50		
Moderate	0	0	6	30		
Tense	0	0	2	10		

< 0.001 \*\* highly statistically significant < 0.05 \* statistically significant.

**Table (2): peripheral neuropathy symptoms and signs between G1 and G2.**

	G1(n=20)		G2(n=20)		X <sup>2</sup>	p. value
	No	%	No	%		
Pain	2	10	8	40	12.48	< 0.05*
Numbness	2	10	8	40	12.48	< 0.05*
weakness	1	5	3	15	3.75	< 0.05*
Superficial sensory loss	2	10	8	40	6.0	<0.001**
Deep sensory loss	1	5	2	10	1.58	> 0.05
Absent ten. Reflex of LL	2	10	4	20	2.72	> 0.05

< 0.001 \*\* highly statistically significant < 0.05 \* statistically significant.

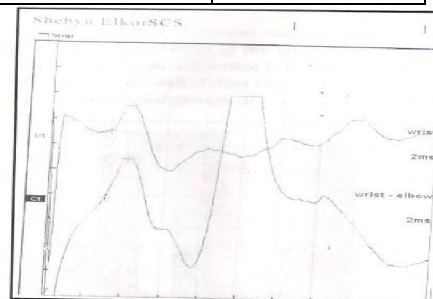
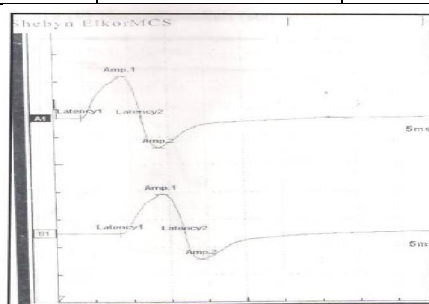
**Table (3): laboratory measurements among the studied groups:**

	G1(n=20) $\bar{x} \pm SD$	G2(n=20) $\bar{x} \pm SD$	G3(n=20) $\bar{x} \pm SD$	P. value of f-test
SGOT	39.3 ± 32.58	48.1 ± 32.36	17.1 ± 5.00	*Sig1, 3/2, 3
SGPT	40.9 ± 30.74	50.9 ± 31.60	17.6 ± 6.34	*Sig1, 3/2, 3
Albumin g/dl	4.05 ± 0.50	2.58 ± 0.45	3.91 ± 0.52	Sig1, 2/1, 3
Bilirubin	0.95 ± 0.07	2.01 ± 0.096	0.97 ± 0.08	Sig1, 2/1, 3
PT activity	89.15 ± 3.85	72.1 ± 11.12	93.65 ± 4.19	Sig1, 2/1, 3
Blood Urea	25.35 ± 4.16	28.45 ± 6.39	24.25 ± 3.08	Sig1, 2/1, 3
Serum creatinine	0.71 ± 0.22	1.12 ± 0.35	0.76 ± 0.29	*Sig1, 2/1, 3
RBCs /mm <sup>3</sup>	3.78 ± 0.47	3.62 ± 0.49	4.30 ± 0.84	Sig1, 3/2, 3
WBCs/mm <sup>3</sup>	6500 ± 1572.80	6150 ± 1598.52	6650 ± 1954.08	NS
Platelet/mm <sup>3</sup>	250100 ± 89103.66	133950 ± 48407.78	257250 ± 76459.05	*Sig1, 2/2, 3
RBS g/dl	118.7 ± 18.81	110.85 ± 13.20	105.35 ± 9.02	Sig1, 3

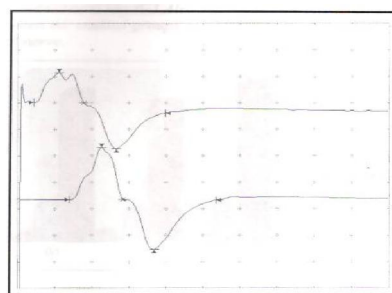
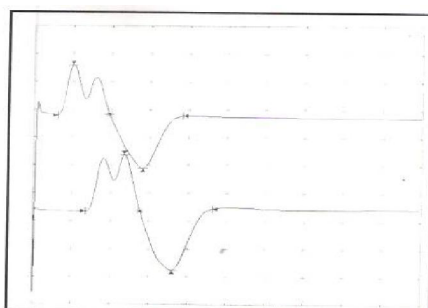
<b>Vit B12 Pg/ml</b>	539.05 ± 138.87	574.95 ± 149.46	533.95 ± 58.05	NS
<b>Complement (C3)</b>	1.39 ± 0.46	1.17 ± 0.64	1.72 ± 0.46	*Sig1,2/2,3

**Table(4): Median nerve conduction study among the studied groups.**

	G1(n=20) $\bar{x} \pm SD$	G2(n=20) $\bar{x} \pm SD$	G3(n=20) $\bar{x} \pm SD$	P.value of f- test
-motor				
Amp	4.85 ± 1.15	4.21 ± 1.58	5.61 ± 1.03	Sig 2, 3
velocity	52.5 ± 16.56	53.90 ± 3.29	55.60 ± 3.07	NS
Latency	3.55 ± 0.69	3.45 ± 0.78	3.39 ± 0.88	NS
-Sensory				
Amp	25.55 ± 8.31	20.85 ± 9.23	27.9 ± 8.01	Sig 2, 3
Velocity	55 ± 2.63	54.9 ± 2.75	57.8 ± 8.56	NS
Latency	2.91 ± 0.26	2.64 ± 0.38	2.70 ± 0.68	NS


**Table(5): Ulnar nerve conduction study among the studied groups**

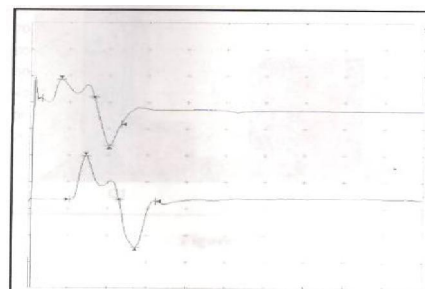
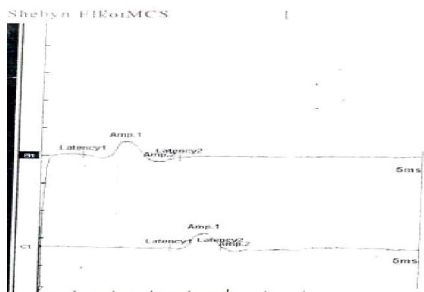
	G1(n=20) $\bar{x} \pm SD$	G2(n=20) $\bar{x} \pm SD$	G3(n=20) $\bar{x} \pm SD$	P.value of f- test
-motor				
Amp	6.48 ± 0.77	5.97 ± 1.26	6.82 ± 0.32	Sig 2, 3
velocity	55.19 ± 3.79	54.52 ± 2.56	55.75 ± 3.26	NS
Latency	3.08 ± 0.21	3.09 ± 0.32	3.01 ± 0.17	NS
-Sensory				
Amp	17.69 ± 3.24	16.76 ± 1.83	18.95 ± 0.89	Sig 2, 3
Velocity	56.71 ± 3.48	58.25 ± 5.16	56.25 ± 2.40	NS
Latency	2.63 ± 0.35	2.59 ± 0.38	2.54 ± 0.20	NS





**Table(6): Peroneal nerve conduction study among the studied groups**

	G1(n=20) $\bar{x} \pm SD$	G2(n=20) $\bar{x} \pm SD$	G3(n=20) $\bar{x} \pm SD$	P.value of f- test
-motor				
Amp	$4.8 \pm 1.11$	$4.38 \pm 1.16$	$5.36 \pm 0.86$	Sig 2, 3
velocity	$48.42 \pm 5.11$	$50.89 \pm 5.87$	$49.9 \pm 5.79$	NS
Latency	$3.77 \pm 0.65$	$4.11 \pm 0.38$	$3.9 \pm 0.59$	NS
-Sensory				
Amp	$22.63 \pm 4.18$	$21.08 \pm 4.76$	$24.54 \pm 4.88$	Sig 2, 3
Velocity	$57.31 \pm 3.86$	$56.21 \pm 3.49$	$57.71 \pm 4.23$	NS
Latency	$3.68 \pm 0.55$	$3.66 \pm 0.30$	$3.87 \pm 0.60$	NS



### Discussion:

Peripheral neuropathy has been reported in association with chronic liver disease, including liver cirrhosis and chronic hepatitis C. However, the reports have varied regarding the incidence and characteristics of this neuropathy and multiple studies were performed to study the peripheral neuropathy in hepatitis C virus and its relation to cryoglobulinaemia.<sup>7</sup>

In the present study peripheral neuropathy was diagnosed by electrophysiological examination in 14 patients (35%) of HCV positive cases and cryoglobulins found in 10 patients (25%), clinical peripheral neuropathy presented in 10 patients (25%).

These findings disagree with reports done by *Cacoub et al., 2001*<sup>8</sup> who diagnosed PN in (9%) of 321 HCV patients on the basis of clinical symptoms only and (*Lucio et al., 2006*)<sup>9</sup> who diagnosed PN by electrophysiological examination detecting (15.3%) and clinical PN (10.6%), so, there are two points, **first**, there was a difference between the percentage of clinically diagnosed PN and the electrophysiologically diagnosed. This explained as that, polyneuropathy diagnosed by combination of multiple items, the symptoms, signs and abnormal electrophysiological studies, whereas, the symptoms alone have poor diagnostic accuracy in predicting the presence of polyneuropathy. **The second** is the percentage of neuropathy in HCV patients may vary significantly in different studies even if the same diagnostic tools are used (clinical,

electrophysiological). This may be due to the fact that, HCV-associated neuropathy is a multifactor disease process, so that, for a given population of HCV patients, there will be mass of details that all can affect significantly the percentage of neuropathy in such patients<sup>10</sup>. the most important is the viral factors such as, viral genotypes as there is wide difference between the viral genotypes in Egypt and western countries<sup>11</sup>.

*Origi et al., 2003*<sup>12</sup> found that, there was a significant difference in the frequency of peripheral nervous system involvement in cryoglobulinaemic HCV patients with different viral genotypes. Other environmental factors that may play a role in the pathogenesis may include the climate, since cryoglobulinaemic manifestations including neuropathy are more aggressive in cold weather.<sup>12</sup> The percentage of cryoglobulin in the present study (25%) agrees with the results of (*Lucio et al., 2006*)<sup>9</sup> who found the percentage of CG was (29.3%) close to the present study but disagrees with (*Cacoub et al., 2001*)<sup>8</sup> who reported a percentage of (56%). The explanation of this difference is not present except that, a wide variability of CG prevalence in HCV patients has been well documented.

In the present study, statistical analysis of peripheral neuropathy symptoms, neurological examination results and the results of nerve conduction study of the HCV patients shows that, PN appears in some HCV patients who do not have cirrhosis and become progressively increased in

patients with cirrhosis denoting that, cirrhosis has a role in the pathogenesis of PN. This agrees with the report of (*Parampreet et al., 2003*)<sup>7</sup> who reported PN in patients with liver cirrhosis.

The explanation of the role of cirrhosis in PN is porto systemic shunting<sup>13</sup>. (*Hindfelt and Holmin, 2006*)<sup>14</sup> proposed hepatocellular failure as the main pathophysiological mechanism for neuropathy and the various mechanisms postulated for this hepatic neuropathy are metabolic inhibition of the axonal membrane function, metabolic damage to schwann cell and even a possible disordered insulin metabolism, something similar to diabetic neuropathy.

The present study shows significant decrease of the amplitude of the median, ulnar and peroneal nerves (sensory and motor) in the group of HCV patients, also there was no statistically significant difference between the studied groups as regard to the conduction velocity and distal latency of median, ulnar and peroneal nerves.

This denoting axonal type of PN and no evidence of demyelinating PN in this study.

These findings agree with (*Lucio et al., 2006*)<sup>9</sup> who reported axonal polyneuropathy affecting both motor and sensory parts of the nerves in HCV+ve cases and (*Parampreet et al., 2003*)<sup>7</sup> who reported axonal polyneuropathy also, sensory and motor in cirrhotic patients.

Significant increase in serum cryoglobulin in peripheral neuropathy patients as 10 (71.43%) patients having peripheral neuropathy are positive CG and the remaining peripheral neuropathy 4 (28.76%) patients are negative CG.

This finding agrees with (*Lucio et al., 2006*)<sup>9</sup> who reported an association between CG and PN but CG is not the only cause of PN.

But this findings disagree with (*Cacoub et al., 2001*)<sup>8</sup> who found no significant association between PN and CG and (*Lidove et al., 2001*)<sup>15</sup> who reported 4 cases with PN in HCV +ve cases without cryoglobulinaemia.

The explanation of PN in HCV patients is by different mechanisms, cryoglobulinaemic neuropathy which is (immune mediated, deposition of cryoglobulins causing ischaemic nerve injury and vasculitis- induced nerve damage)<sup>16</sup>, HCV-associated guillian- barrie syndrome<sup>17</sup>, and the non cryoglobulinaemic neuropathy which can be explained by occurrence of serum sickness- like state that leads to vasculitis in the vasa nervosum.<sup>18</sup>

The present study showed that, significant decrease of the amplitude of median, ulnar and peroneal nerves (motor and sensory) in cryoglobulinaemic patients denoting increase the

incidence of axonal sensory motor polyneuropathy with cryoglobulin +ve patients.

These findings agree with (*Lucio et al., 2006*)<sup>9</sup> who reported axonal sensory motor polyneuropathy in patients with cryoglobulinaemia.

The explanation may be vasculitis induced nerve damage as there is vascular infiltrates in nerve tissue in vasculitis which are composed of T cells and macrophages and such cells are thought to play a role in vasculitic lesions, where these cells express certain molecules which may lead to neural vessel injury<sup>19</sup>. But **Kardel and Nielsen**<sup>20</sup> postulated the axonal neuropathy which is not related to the CG, to serum sickness like or direct effect of the virus.

Cryoglobulin was +ve in 3 patients of the first group versus 7 patients of the second group and significant lower level of C3 in patients of the second group than the first group.

These findings disagree with the reports done by (*Parampreet et al., 2003*)<sup>7</sup> who reported that, there is no relation between CG and cirrhosis.

The explanation of the high percentage of CG in HCV with cirrhosis than HCV patients without cirrhosis may be the small number of patients taken and the CG present in the cirrhotic may be one of the extrahepatic manifestations of HCV which is the original cause of cirrhosis.

In the present study, statistical analysis showed that, significant increase in PN and cryoglobulins with the age of the patients while no significant relation between PN and CG to the sex of the patients.

This agrees with (*Lucio et al., 2006*)<sup>9</sup> who reported a strong correlation between old age and peripheral neuropathy.

Some authors have already noted that, older age is a major risk factor for the clinical and biological extrahepatic manifestations of HCV patients<sup>21</sup>.

**Conclusion:** This study concluded that, PN is present in HCV patients without cirrhosis and become progressively increased in HCV patients with cirrhosis, PN in HCV patients is polyneuropathy and axonal, both sensory and motor, PN may be clinically diagnosed or sub clinically diagnosed by electrophysiological examination in HCV patients, Cryoglobulins significantly increased in HCV patients with peripheral neuropathy, Peripheral neuropathy significantly increased in HCV patients with CG than in HCV patients without CG, PN and CG increased significantly with age .

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**Distance Education in Agricultural Education**<sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi<sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home. The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.

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**Keywords:** Distance Education, Agricultural Education

**Introduction:**

enjoying and giving publicity to any of technological tools with the aim to facilitate and accelerate the training process, as well as increase the quality and quantity of knowledge quality and knowledge of a serious intelligence community needs to integrate and standardize the educational system society is.

Hence, considering the position and role of education in the third millennium on the basis of ICT is also a serious approach to the topic with the knowledge community centered on learning and general trends of technological tools to enjoy much of the information and Find the appropriate place in the information society Third Millennium That actually can be a global community and is without limit is undeniable-and-run. Guidance and therefore move in the direction of society should be education and technology for comprehensive pandemic done. Considering the above definitions and with the knowledge and attitudes towards the third millennium and the desirability and some weaknesses in the achievement of certain standards and dynamic structures in order to achieve a knowledge based society, there is. In the present circumstances to provide our information infrastructure development and integration inevitably link the elements and tools that they are as indicators of technology education and technology education will be remembered. In the new context of combining these two indicators comes to training facilities and a variety of tools that will provide guidance and development in information will be very effective.

While the effect of these two indices of body functions and its other fields (favorable to foster new ideas provides. Technologies training web-based

technology as one of the most effective learning tools in educational issues have been identified and a total of E-learning as it is referred. . But if the scientific and cultural infrastructure with this technology's Day is not coordinated development of information will be obtained. This weakness caused by lack of growth and development of training required for pandemic knowledge of existing technology is. In many systems of scientific tools and capabilities needed to provide hardware and commissioning are still technological problems resulting from lack of knowledge of poverty and poor education in these centers to be seen.

In other words, the country still in the feasibility assessment and appropriate to make public the necessary training for operation and application of scientific principles and technological tools is has been done and why certain movements and sometimes non-normative point will not be able node an unlock.

The conditions and according to the capacity of developing countries and training facilities required a knowledge-based society feels is felt. If all processes in technology education and technology optimization and standardization of the Hungarian education should go, and appropriate channels that the best option in this area could benefit from state universities is capabilities.

According to the information in the development of any society should take half of the world to progress until the necessary coordination and synchronization global developments so as to accept the design structure of a knowledge-based society have a special place for the University and respect the role of

education and technology was In designing a model with global standards of dynamism and flexibility at first be necessary to select a sample that the facilities and communications needed for this purpose provide action and then determine optimal cognitive deficiencies than Hammett and weaknesses push.

No doubt the experiences of implementing these standards and to develop troubleshooting information using technological tools would be much more economical. That if we develop a range of information from a city university level and conduct more successful we'll be more acceptable was. Because the utilization and application tools and step up the information they've been successful. Therefore the most important first step needed to coordinate and synchronize technology education and educational technology standards and capability in the high user acceptability of the world is also enjoyed.

#### **Benefits of Distance Learning:**

Benefits and opportunities that distance education provides, include:

- training a wide range of audiences.
- meet the needs of students and students who can not attend in place.
- Possible connection between students and students with cultures, beliefs and experiences are different.
- Benefiting from coaches and speakers who do not live in the country.

#### **Educational methods in distance learning:**

Today, under the new system replaced the traditional systems of learning and learning week (ie tutoring methods, lectures) are:

##### **- Multimedia courses:**

These courses and widely used elements of image, communication, graphics and simulated components, animation and communication elements for guidance and tips, and talk back on course and curriculum issues are held.

##### **- Enhanced communication mechanisms:**

The mechanism of any texts simultaneously, and asynchronous audio-visual communications to protect you. This case allows students to practice on topics learned will give.

##### **- Written test:**

thus, question and test via a distributed communication network, are corrected and returned. These exams through video conferencing support and runs.

##### **-Virtual Seminar:**

thereby different groups of students in different geographical environments linked together makes.

##### **- Collaborative virtual laboratories:**

the laboratory of the Group's activities are supported. Workshops such as software engineering.

#### **-Smart academic factors:**

academic factors that inform intelligent, support and guidance students pay.

#### **Remote educational tool:**

distance learning tools and supplies various uses. These tools in four main courses are:

##### **A - Audio Tools:**

Audio tools include training such as two-way interactive telephone, video conference, shortwave radio and a strain of tools such as audio tape and radio.

##### **B - Image tools:**

including slides, films, video tapes and video conferences.

##### **C - Data:**

computers as electronic data are sent and received. Because the data word description for a wide range of educational tools is used.

Computer applications for distance education are varied and include the following:

- 1- Training to Computer Management.
- 2 - Computer Assisted Instruction.
- 3 - through PCs.
- 4 - e-mail, telegraph, computer conference and the World Wide Web simultaneously.

##### **D - Print:**

The main element of distance education programs, particularly in the exchange and delivery system information tools are considered.

#### **Key factors in the process of distance education:**

the process of remote training, the following factors contribute:

##### **- Students:**

Regardless of educational content, role and main element in the learning process students are responsible.

##### **- Coaches and Teachers:**

Success depends on a lot of educational activities the ability, skills and knowledge are the coaches and professors.

##### **- Facilitators of communication:**

Facilitator bases, as the bridge between students and mentors are. Must base expectations of teachers and educational needs of students and service coordination and communication to create.

##### **- Support staff:**

One of the important pillars of any development of distance education programs, by development group finds. Operational support staff such as student



registration, copy and distribute their resources, order textbooks, security and copyright, and are responsible for the report.

- Management:

The group decision makers, builders and judges are considered to be educational and should be considered among the factors above, establish the correct relationship formation.

## FORMS OF DISTANCE EDUCATION

In its original form, teachers using distance education traveled to remote sites and taught a class, or corresponded with students through mail, telephone, or fax machine. Individualized study has been a method of reaching the remote student for some time. Detailed course instructions are sent to the learner who performs the assigned tasks and returns the completed work to the teacher for evaluation and reassignment if necessary.

Technology has raised the quality of individualized distance instruction. The use of various forms of electronic media increases time effectiveness and improves the delivery of information. Video, audio, and computer-based applications may enhance the product received by the independent learner. Electronic delivery can occur using synchronous communication, in which class members participate at the same time, or asynchronous communication where participants are separated by time (Romiszowski, 1993).

Video/audio models of distance education include broadcast television, cable television, satellite, microwave, fiber optics, and audio graphics. The most widely used format is broadcast and cable television (Parrott, 1995). However, developments in satellite and fiber optic systems have produced other successful programs. The interactive capability of many of these networks has produced a distance classroom that is nearly identical to a regular classroom. Teachers and students can interact through both two-way video and one-way video with two-way audio systems. The recent development of Desktop Video Conferencing (DVC) which brings interactive video capability to the desktop computer, further enhances learning opportunities.

The linking of computer technology through the use of the Internet or CD-ROM with television transmission provides a potentially new dimension to distance education. This technique can link university

professors to high school teachers, or to physically disabled students, in a distance setting (McLean, 1996).

Another form of interaction is the use of computer conferencing. This method utilizes asynchronous communication in such forms as an e-mail list group, an Internet discussion group, or other types of conferencing software. Asynchronous methods of communication are especially appealing to the learner who has difficulty scheduling specific time- and place-bound course work.

## Conclusion:

Distance education delivers classes (live or pre-taped) to students in their home, office, or classroom. It is used by K-12, higher education, continuing education and business. As the cost of delivering quality education increases, institutions find that limited resources prevent them from building facilities, hiring faculty, or expanding curricula. They are using distance education to maximize resources and are combining their assets with others to produce programming. Distance education is offered internationally, nationally, regionally, and locally over all forms of conferencing technology.

Distance learning is expanding and examples of it are increasing dramatically. Fewer than 10 states were using distance learning in 1987; today, virtually all states have an interest or effort in distance education. Distance learning systems connect the teacher with the students when physical face-to-face interaction is not possible. Telecommunications systems carry instruction, moving information instead of people. The technology at distant locations are important and affect how interaction takes place, what information resources are used, and how effective the system is likely to be.

Technology transports information, not people. Distances between teachers and students are bridged with an array of familiar technology as well as new information age equipment. What sets today's distance education efforts apart from previous efforts is the possibility of an interactive capacity that provides learner and teacher with needed feedback, including the opportunity to dialogue, clarify, or assess. Advances in digital compression technology may greatly expand the number of channels that can be sent over any transmission medium, doubling or even tripling channel capacity. Technologies for learning at a distance are also enlarging our definition

of how students learn, where they learn, and who teaches them. No one technology is best for all situations and applications. Different technologies have different capabilities and limitations, and effective implementation will depend on matching technological capabilities to education needs.

Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home.

The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.

Interactivity is accomplished via telephone (one-way video and two-way audio), two-way video or graphics interactivity, two-way computer hookups, two-way audio. Interactivity may be delayed but interaction provided by teacher telephone office hours when students can call or through time with on-site facilitators. Classes with large numbers of students have a limited amount of interactivity. Much of the activity on computer networks is on a delayed basis as well. Possibilities for audio and visual interaction are increasingly wide.

In the earlier days of distance learning, it was most common to see distance learning used for rural students who were at a distance from an educational institution. The student might watch a telecourse on a television stations, read texts, mail in assignments and then travel to the local college to take an exam. This model is still in use, but as the technology has become more sophisticated and the cost of distance learning dropped as equipment prices dropped, the use of distance education has increased.

High front-end costs prevented an early widespread adoption of electronically mediated learning. Distance learning has been aggressively adopted in many areas because it can meet specific educational needs. As the concept of accountability became accepted and laws required certain courses in high school in order for students to be admitted to state colleges, telecommunications was examined as a way to provide student access to the required courses. Many rural school districts could not afford the special teachers to conduct required courses. Distance education met this need by providing courses in schools where teachers were not available or were too costly to provide for a few students. It also fulfilled a need for teacher training and staff development in locations where experts and resources were difficult to obtain. These systems link learner communities with each other and bring a wide array of experts and information to the classroom.

Challenges which faced the early users of distance education are still with us today. If distance education is to play a greater role in improving the quality of education, it will require expanded technology; more linkages between schools, higher education, and the private sector; and more teachers who use technology well. Teachers must be involved in planning the systems, trained to use the tools they provide, and given the flexibility to revise their teaching. Federal and state regulations will need revision to ensure a more flexible and effective use of technology. Connections have been established across geographic, instructional, and institutional boundaries which provide opportunities for collaboration and resource sharing among many groups. In the pooling of students and teachers, distance learning reconfigures the classroom which no longer is bounded by the physical space of the school, district, state or nation.

The key to success in distance learning is the teacher. If the teacher is good, the technology can become almost transparent. No technology can overcome poor teaching which is actually exacerbated in distance education applications. When skilled teachers are involved, enthusiasm, expertise, and creative use of the media can enrich students beyond the four walls of their classroom.

Teachers need training in the system's technical aspects and in the educational applications of the technology. Areas for assistance include the amount of time needed to prepare and teach courses, how to establish and maintain effective communication with students, strategies for adding visual components to

audio courses, ways to increase interaction between students and faculty, planning and management of organizational details, and strategies for group cohesion and student motivation.

The interchange of ideas requires different communication methods than in conventional classrooms: information technologies are predominantly visual media, rather than the textual and auditory environment of the conventional classroom, the affective content of mediated messages is muted compared to face-to-face interaction, and complex cognitive content can be conveyed more readily in electronic form because multiple representations of material (e.g., animations, text, verbal descriptions, and visual images) can be presented to give learners many ways of understanding the fundamental concept.

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### Distance Education in Developing Countries

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**Abstract:** Distance education is a method of education in which the learner is physically separated from the teacher and the institution sponsoring the instruction. It may be used on its own, or in conjunction with other forms of education, including face-to-face instruction. In any distance education process there must be a teacher, one or more students, and a course or curriculum that the teacher is capable of teaching and the student is trying to learn. The contract between teacher and learner, whether in a traditional classroom or distance education, requires that the student be taught, assessed, given guidance and, where appropriate, prepared for examinations that may or may not be conducted by the institution. This must be accomplished by two-way communication. Learning may be undertaken either individually or in groups; in either case, it is accomplished in the physical absence of the teacher in distance education. Where distance teaching materials are provided to learners, they are structured in ways that facilitate learning at a distance.

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**Keywords:** Distance Education, Developing Countries

#### Introduction:

The background of distance education to mid-nineteenth century dates. Pioneers in America and Europe of the best distance learning technologies for training that day, took advantage. For example: mailing system for creating educational opportunities for those able to go to regular schools were not interested in science education, but had been used. Of course at that time most of those who took advantage of this type of Physically Handicapped facilities, women allowed to attend the classes along with men who did not have a. Location is N. There was a school; were. One of the pioneers in this field English personal name was Isaac Pitman. His short-term training through correspondence and the correspondence began in 1840 in England. Students were required to read the Bible a part of written questions and answers raised by Pittman to get a good score should return by mail.

But distance education in America and for the first time at the University of Illinois Veslin was implemented in 1874. In 1900, university education through correspondence, face became more public. National Association of Home Education in 1926 and led the establishment of distance education and related programs in universities and schools, and more important aspect to find drivers. Education in 1920 invented the radio and TV appearance in 1940 led to important new techniques in communications

that the nature of the field of distance education also created dramatic changes.

Trainers using these new technologies were successful educational programs to millions seek learning opportunities and thereby reach out to the educational spaces, training centers to expand. With the development of long-distance telephone system in the early twentieth century method of capacity and distance learning methods for students to access educational opportunities in the world increased Translation. But until the invention of mobile tele conference ever in the 80 and 90 and the main role in the concept of distance education did not play. Telemetry system, allowing for teachers conference provided that without the slightest delay at a time when your students can listen to them talk and sometimes they see.

Expansion of computer networks in the decade 1990 and connect millions of people through lines to the telephone networks made it possible to simply distance learning via computers and computer conferences around the world is possible (a) and Today with the development of control technology in science and technology around the world are.

#### What is Distance Education?

Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance



study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-instructor relationship, which is the hallmark of distance education instruction.

Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology. Courses are offered in gemology, high school diploma, journalism, locksmithing, child day care management, yacht design, and many fascinating subjects. Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study.

Since 1890, more than 130 million Americans have studied at DETC member institutions, including Franklin D. Roosevelt, Walter P. Chrysler, Walter Cronkite, Barry Goldwater, Charles Schulz, and many other distinguished alumni of DETC members. Unlike most distance education courses offered by traditional colleges and universities that are semester and classroom oriented, with courses offered by most of the DETC-accredited institutions you can study any time and anywhere. Distance education is especially suited for busy people who wish to increase their knowledge and skills without giving up their jobs, leaving home, or losing income. You learn while you earn. Many courses provide complete vocational training; others prepare you for upgrading in your present job, without losing wages, experience or seniority. You receive individual attention, and you work at your own pace.

In recent years, technology has played a significant role in transforming the traditional distance education school into a dynamic, interactive distance learning

method using toll-free telephone lines, as well as a diverse array of personal computers, video devices, CD and DVD ROMs, online courses over the Internet, interactive devices, and other modern technological innovations. The future for distance study promises to be exciting!

## FORMS OF DISTANCE EDUCATION

In its original form, teachers using distance education traveled to remote sites and taught a class, or corresponded with students through mail, telephone, or fax machine. Individualized study has been a method of reaching the remote student for some time. Detailed course instructions are sent to the learner who performs the assigned tasks and returns the completed work to the teacher for evaluation and reassignment if necessary.

Technology has raised the quality of individualized distance instruction. The use of various forms of electronic media increases time effectiveness and improves the delivery of information. Video, audio, and computer-based applications may enhance the product received by the independent learner. Electronic delivery can occur using synchronous communication, in which class members participate at the same time, or asynchronous communication where participants are separated by time (Romiszowski, 1993).

Video/audio models of distance education include broadcast television, cable television, satellite, microwave, fiber optics, and audio graphics. The most widely used format is broadcast and cable television (Parrott, 1995). However, developments in satellite and fiber optic systems have produced other successful programs. The interactive capability of many of these networks has produced a distance classroom that is nearly identical to a regular classroom. Teachers and students can interact through both two-way video and one-way video with two-way audio systems. The recent development of Desktop Video Conferencing (DVC) which brings interactive video capability to the desktop computer, further enhances learning opportunities.

The linking of computer technology through the use of the Internet or CD-ROM with television transmission provides a potentially new dimension to distance education. This technique can link university professors to high school teachers, or to physically

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Another form of interaction is the use of computer conferencing. This method utilizes asynchronous communication in such forms as an e-mail list group, an Internet discussion group, or other types of conferencing software. Asynchronous methods of communication are especially appealing to the learner who has difficulty scheduling specific time- and place-bound course work.

### **ADAPTABILITY**

Distance education can be used for some aspects of most disciplines. For example, several institutions of higher education already have developed certificate programs, undergraduate programs, and graduate programs in health and physical education that are delivered using distance education methods. Eastern Oregon University, Emporia State University, Kutztown University, LaSalle University, the Medical College of Wisconsin, University of Wisconsin at Stevens Point, and Virginia Tech are among institutions integrating distance technology into their physical education programs.

Traditional programs that are heavily based in skill development and demonstration or require laboratory work can be offered in a distance education framework using interactive video interfaced with computers to facilitate a hands-on learning approach at a distance. Classes that use lecture and laboratory experiences are easily adapted to a distance education situation. Course materials, including animals for dissection, are sent to class participants with video and written instructions and assignments.

### **EFFECTIVE TEACHING AND LEARNING WITH DISTANCE EDUCATION**

Distance education dictates changes in behavior for both the teacher and the learner. The successful student develops persistence and skills in self-directing work. The successful distance education teacher becomes conversant with new technology and develops new instructional styles, moving from creating instruction to managing resources and students and disseminating views (Strain, 1987). Administrative and faculty support for distance

education are critical to the success of this instructional method. Administrators should take note that the implementation of a distance education program may allow access to a greater number of students. However, the time and work associated with teaching at a distance exceeds the normal requirements of campus-based instruction.

Students in distance education settings perform as well or better on assignments, class activities, and exams when compared to campus-based students (St. Pierre, 1998). Nevertheless, students must maintain persistence and a clear focus to succeed in a distance learning situation. Self-direction, a passion for learning, and strong individual responsibility are important influences on achievement. There are indications that distance education works best for more mature, motivated, well-organized, and already accomplished learners (Rintala, 1998).

Garrels (1997) describes five critical elements for successful teaching at a distance:

1. **Instructor enthusiasm.** This requires animation and comfort in front of the camera, or with the technology utilized. Faculty support and interest are critical to the success of distance learning endeavors.
2. **Organization.** Teaching materials must be prepared in advance; timing, variation, and smooth transitions must be planned. Instructors should allocate from 3 to 5 hours of preparation for each hour of distance instruction. Great attention to detail is required long before the actual classroom activity occurs (Summers, 1997).
3. **Strong commitment to student interaction.** Whatever the modality used to teach at a distance, the instructor must encourage and facilitate ongoing communication between the students and the instructor.
4. **Familiarity with the technology used in the class format.** Faculty development is important before beginning any distance activities, and instructors should be trained in video use, computer use, or other forms of instructional technology used.
5. **Critical support personnel.** Production staff, graphic designers, and technical staff members will help the instructional setting produce successful teaching at a distance.

Distance education is any type of schooling that takes place away from a physical campus. Distance education is also known as:

- distance learning
- virtual learning
- online learning
- e-learning
- online education
- web-based training

### Types of Distance Education Programs:

There are two types of programs offered by distance education schools: synchronous learning programs and asynchronous learning programs. With synchronous learning, distance education students must log on to the school's website at a set time. Often, they interact with their peers and professors via group chats, web seminars, video conferencing, and phone call-ins. With asynchronous learning, distance education students complete all coursework on their own time. They often learn via assignment sheets, message boards, email, pre-recorded video lectures, mp3s, and traditional mail correspondence.

Distance education began for the delivery of courses to students who live in remote areas. Over the years, though, this form of education has become the preferred method for learning outside of the classroom.

Distance Education is now undertaken by people with busy schedules, hectic lifestyles, special needs, and also those living in isolated areas. What's more, with such flexible learning options you can choose to study at any time and from any location you like.

There are a number of different **forms of distance education** and it's important to know which method you prefer:

- **Correspondence learning:** your course materials are printed and sent out to you by mail/courier. The advantages are that you have a printed set of reference materials, you can study anywhere and you are not reliant on a computer, you can learn for long periods of time.
- **eLearning:** your course materials are provided to you in multimedia format; that

is, on CD/DVD. In this way you can choose to take your study materials within you and learn anywhere in the world with just a laptop.

- **Online learning:** no materials are sent to you and you do all your learning online. The limitation is that you need to be logged onto a computer (though you may be able to download and print some of your materials yourself, though this can cost you more in ink), there is a limit to how much you can absorb and do online, and most people's attention span on-screen is limited to 20 minutes (your eyes get tired after that).
- **Broadcast learning:** where you tune into a series of television, radio or Internet broadcasts (e.g. podcast, YouTube, etc.).
- **Teleconferencing:** where your lessons are conducted in real time through an Internet connection. Limitations are that streaming can be slow, connections can cause problems (students and teachers generally need to be computer literate) and there can be delays in talk-time, depending on software, hardware and connection capabilities.

### Conclusion:

Distance education delivers classes (live or pre-taped) to students in their home, office, or classroom. It is used by K-12, higher education, continuing education and business. As the cost of delivering quality education increases, institutions find that limited resources prevent them from building facilities, hiring faculty, or expanding curricula. They are using distance education to maximize resources and are combining their assets with others to produce programming. Distance education is offered internationally, nationally, regionally, and locally over all forms of conferencing technology.

Distance learning is expanding and examples of it are increasing dramatically. Fewer than 10 states were using distance learning in 1987; today, virtually all states have an interest or effort in distance education. Distance learning systems connect the teacher with the students when physical face-to-face interaction is not possible. Telecommunications systems carry instruction, moving information instead of people. The technology at distant locations are important and affect how interaction takes place, what information resources are used, and how effective the system is likely to be.

Technology transports information, not people. Distances between teachers and students are bridged with an array of familiar technology as well as new information age equipment. What sets today's distance education efforts apart from previous efforts is the possibility of an interactive capacity that provides learner and teacher with needed feedback, including the opportunity to dialogue, clarify, or assess. Advances in digital compression technology may greatly expand the number of channels that can be sent over any transmission medium, doubling or even tripling channel capacity. Technologies for learning at a distance are also enlarging our definition of how students learn, where they learn, and who teaches them. No one technology is best for all situations and applications. Different technologies have different capabilities and limitations, and effective implementation will depend on matching technological capabilities to education needs.

Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home.

The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.

Interactivity is accomplished via telephone (one-way video and two-way audio), two-way video or graphics interactivity, two-way computer hookups, two-way audio. Interactivity may be delayed but interaction provided by teacher telephone office hours when students can call or through time with on-site facilitators. Classes with large numbers of students have a limited amount of interactivity. Much of the activity on computer networks is on a delayed

basis as well. Possibilities for audio and visual interaction are increasingly wide.

In the earlier days of distance learning, it was most common to see distance learning used for rural students who were at a distance from an educational institution. The student might watch a telecourse on a television stations, read texts, mail in assignments and then travel to the local college to take an exam. This model is still in use, but as the technology has become more sophisticated and the cost of distance learning dropped as equipment prices dropped, the use of distance education has increased.

High front-end costs prevented an early widespread adoption of electronically mediated learning. Distance learning has been aggressively adopted in many areas because it can meet specific educational needs. As the concept of accountability became accepted and laws required certain courses in high school in order for students to be admitted to state colleges, telecommunications was examined as a way to provide student access to the required courses. Many rural school districts could not afford the special teachers to conduct required courses. Distance education met this need by providing courses in schools where teachers were not available or were too costly to provide for a few students. It also fulfilled a need for teacher training and staff development in locations where experts and resources were difficult to obtain. These systems link learner communities with each other and bring a wide array of experts and information to the classroom.

Challenges which faced the early users of distance education are still with us today. If distance education is to play a greater role in improving the quality of education, it will require expanded technology; more linkages between schools, higher education, and the private sector; and more teachers who use technology well. Teachers must be involved in planning the systems, trained to use the tools they provide, and given the flexibility to revise their teaching. Federal and state regulations will need revision to ensure a more flexible and effective use of technology. Connections have been established across geographic, instructional, and institutional boundaries which provide opportunities for collaboration and resource sharing among many groups. In the pooling of students and teachers, distance learning reconfigures the classroom which no longer is bounded by the physical space of the school, district, state or nation.

The key to success in distance learning is the teacher. If the teacher is good, the technology can become almost transparent. No technology can overcome poor teaching which is actually exacerbated in distance education applications. When skilled teachers are involved, enthusiasm, expertise, and creative use of the media can enrich students beyond the four walls of their classroom.

Teachers need training in the system's technical aspects and in the educational applications of the technology. Areas for assistance include the amount of time needed to prepare and teach courses, how to establish and maintain effective communication with students, strategies for adding visual components to audio courses, ways to increase interaction between students and faculty, planning and management of organizational details, and strategies for group cohesion and student motivation.

The interchange of ideas requires different communication methods than in conventional classrooms: information technologies are predominantly visual media, rather than the textual and auditory environment of the conventional classroom, the affective content of mediated messages is muted compared to face-to-face interaction, and complex cognitive content can be conveyed more readily in electronic form because multiple representations of material (e.g., animations, text, verbal descriptions, and visual images) can be presented to give learners many ways of understanding the fundamental concept.

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**Distance Learning: definitions and applications**<sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh<sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology. Courses are offered in gemology, high school diploma, journalism, lock smiting, child day care management, yacht design, and many fascinating subjects. Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study.

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**Keywords:** Distance Learning, Distance education

**Introduction:**

enjoying and giving publicity to any of technological tools with the aim to facilitate and accelerate the training process, as well as increase the quality and quantity of knowledge quality and knowledge of a serious intelligence community needs to integrate and standardize the educational system society is.

Hence, considering the position and role of education in the third millennium on the basis of ICT is also a serious approach to the topic with the knowledge community centered on learning and general trends of technological tools to enjoy much of the information and Find the appropriate place in the information society Third Millennium That actually can be a global community and is without limit is undeniable-and-run. Guidance and therefore move in the direction of society should be education and technology for comprehensive pandemic done. Considering the above definitions and with the knowledge and attitudes towards the third millennium and the desirability and some weaknesses in the achievement of certain standards and dynamic structures in order to achieve a knowledge based society, there is. In the present circumstances to provide our information infrastructure development and integration inevitably link the elements and tools that they are as indicators of technology education and technology education will be remembered. In the new context of combining these two indicators comes to training facilities and a variety of tools that will provide guidance and development in information will be very effective While the effect of these two indices of body functions and its other fields (favorable to foster new ideas provides. Technologies training web-based technology as one of the most effective learning tools in educational issues have been identified and a total of E-learning as it is referred. . But if the scientific and cultural

infrastructure with this technology's Day is not coordinated development of information will be obtained. This weakness caused by lack of growth and development of training required for pandemic knowledge of existing technology is. In many systems of scientific tools and capabilities needed to provide hardware and commissioning are still technological problems resulting from lack of knowledge of poverty and poor education in these centers to be seen.

In other words, the country still in the feasibility assessment and appropriate to make public the necessary training for operation and application of scientific principles and technological tools is has been done and why certain movements and sometimes non-normative point will not be able node an unlock.

The conditions and according to the capacity of developing countries and training facilities required a knowledge-based society feels is felt. If all processes in technology education and technology optimization and standardization of the Hungarian education should go, and appropriate channels that the best option in this area could benefit from state universities is capabilities.

According to the information in the development of any society should take half of the world to progress until the necessary coordination and synchronization global developments so as to accept the design structure of a knowledge-based society have a special place for the University and respect the role of education and technology was In designing a model with global standards of dynamism and flexibility at first be necessary to select a sample that the facilities and communications needed for this purpose provide action and then determine optimal cognitive deficiencies than Hammett and weaknesses push.

No doubt the experiences of implementing these standards and to develop troubleshooting information using technological tools would be much more economical. That if we develop a range of information from a city university level and conduct more successful we'll be more acceptable was. Because the utilization and application tools and step up the information they've been successful. Therefore the most important first step needed to coordinate and synchronize technology education and educational technology standards and capability in the high user acceptability of the world is also enjoyed.

#### **Definition of distance learning:**

in distance education teachers often are separate and comprehensive. Preparation of educational materials, supporting learners under the supervision of a training center takes place almost never do as a group are not. For services to education and electronic learning aids such as printed materials, computers and the Internet rely on.

Another look at the educational system of a new e-business and artistic and is a comprehensive solution to the institutions that want to move in the direction that technology and change their teaching methods and environments are possible to achieve the new educational approach provides.

#### **Benefits of Distance Learning:**

Benefits and opportunities that distance education provides, include:

- training a wide range of audiences.
- meet the needs of students and students who can not attend in place.
- Possible connection between students and students with cultures, beliefs and experiences are different.
- Benefiting from coaches and speakers who do not live in the country.

#### **Educational methods in distance learning:**

Today, under the new system replaced the traditional systems of learning and learning week (ie tutoring methods, lectures) are:

##### **- Multimedia courses:**

These courses and widely used elements of image, communication, graphics and simulated components, animation and communication elements for guidance and tips, and talk back on course and curriculum issues are held.

##### **- Enhanced communication mechanisms:**

The mechanism of any texts simultaneously, and asynchronous audio-visual communications to protect you. This case allows students to practice on topics learned will give.

##### **- Written test:**

thus, question and test via a distributed communication network, are corrected and returned. These exams through video conferencing support and runs.

#### **-Virtual Seminar:**

thereby different groups of students in different geographical environments linked together makes.

#### **- Collaborative virtual laboratories:**

the laboratory of the Group's activities are supported. Workshops such as software engineering.

#### **-Smart academic factors:**

academic factors that inform intelligent, support and guidance students pay.

#### **Remote educational tool:**

distance learning tools and supplies various uses. These tools in four main courses are:

##### **A - Audio Tools:**

Audio tools include training such as two-way interactive telephone, video conference, shortwave radio and a strain of tools such as audio tape and radio.

##### **B - Image tools:**

including slides, films, video tapes and video conferences.

##### **C - Data:**

computers as electronic data are sent and received. Because the data word description for a wide range of educational tools is used.

Computer applications for distance education are varied and include the following:

- 1- Training to Computer Management.
- 2 - Computer Assisted Instruction.
- 3 - through PCs.
- 4 - e-mail, telegraph, computer conference and the World Wide Web simultaneously.

#### **D - Print:**

The main element of distance education programs, particularly in the exchange and delivery system information tools are considered.

#### **Key factors in the process of distance education:**

the process of remote training, the following factors contribute:

##### **- Students:**

Regardless of educational content, role and main element in the learning process students are responsible.

##### **- Coaches and Teachers:**

Success depends on a lot of educational activities the ability, skills and knowledge are the coaches and professors.

##### **- Facilitators of communication:**

Facilitator bases, as the bridge between students and mentors are. Must base expectations of teachers and

educational needs of students and service coordination and communication to create.

- Support staff:

One of the important pillars of any development of distance education programs, by development group finds. Operational support staff such as student registration, copy and distribute their resources, order textbooks, security and copyright, and are responsible for the report.

- Management:

The group decision makers, builders and judges are considered to be educational and should be considered among the factors above, establish the correct relationship formation.

### What is Distance Education?

Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-instructor relationship, which is the hallmark of distance education instruction. Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology. Courses are offered in gemology, high school diploma, journalism, lock smiting, child day care management, yacht design, and many fascinating subjects.

Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to

complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study. Since 1890, more than 130 million Americans have studied at DETC member institutions, including Franklin D. Roosevelt, Walter P. Chrysler, Walter Cronkite, Barry Goldwater, Charles Schulz, and many other distinguished alumni of DETC members. Unlike most distance education courses offered by traditional colleges and universities that are semester and classroom oriented, with courses offered by most of the DETC-accredited institutions you can study any time and anywhere. Distance education is especially suited for busy people who wish to increase their knowledge and skills without giving up their jobs, leaving home, or losing income. You learn while you earn. Many courses provide complete vocational training; others prepare you for upgrading in your present job, without losing wages, experience or seniority.

### What is Distance Learning: Definition of Distance Learning?

Distance education or distance learning is a mode or education which provides its service online, via specially designed Internet applications (called e-Learning software application), to individual students who study from home or any other convenient place of their choice, as long as it has an Internet connection. It is called distance learning, because students can learn "at a distance", i.e. without the need to commute to remote campuses and be present during classes in person – Distance students study from home, via computers.

### The Distance Learning Main Aspects

Let us define and consider some features it provides:

**1. No Physical attendance:** The traditional model of education requires regular physical attendance in classes in a specific geographically located campus. This has always been both a source of interest and a source of difficulties for many students. It requires strict attendance during the day only and entails travel expenses and time spent commuting instead of studying.

The distance learning model eliminates physical campuses, eliminating the need to waste time and money on travel. It allows students to take courses during individually scheduled hours in any time of

day or night. It means, furthermore, than now it is possible to attend any institution, regardless of how "where" it is located geographically – all online institutions are located online and admit students from any country, no matter how remote. It should be noted that some online education programs do require occasional physical attendance on specially designed sites, most often for the purpose of taking an exam.

**2. High-Quality Education:** A very important point to be aware of is that Distance Learning becomes increasingly recognized as high-quality education. That is, it is not simply a poor substitute to the traditional model, but very valid option for anyone to take.

**3. Human interactions:** Distance Learning is often criticized for its lack of real human interactions, but more and more courses are offered using real-time live video lectures, in addition to email, chat, message boards, and forums for communication.

**4. Multimedia:** In addition, online courses allow uses of multimedia which are impossible in traditional classes.

**5. Continues Education – Or adult Education:** The segments of society currently most enthusiastic about online education are primarily adults who work full time and parents. Tuition are either a little lower or compatible for those for traditional education.

### Conclusion:

In general, new methods of educational systems to countries around the world as a necessity and need for learning and training opportunities to study in areas with different climatic features and conditions of learning and education according to their gender and cultures, has been. Each method is mentioned with regard to changes in features and creates an education system, and evaluation is used. Judgement of distance education in an educational way, first as a necessity to eliminate barriers to educational climate and geographical areas, age and gender restrictions learners began their work And more in a death education system, especially in the philosophy and goals based on theories of learning theories have evolved to find and promote professional growth. Approach to distance education with regard to the necessity of education in countries formed.

Emergence and development of information societies is the consequences of industrialization. Despite the diversity of information in various forms of media in local, national and international, access, exchange

and use of various information easier than last time is. Information society, a member of your buddies know that open information system in terms of geographical location and the last 25 years, organizational development, are limited. Distance learning faster than other forms of training has been. Growth factor in the economic interests of this type of educational approach, flexibility and remove the distance can be named. The methods of distance education, required for building physical education is not providing services. Teachers and trainers in this method - compared with traditional methods - and have more opportunities to more people than are being trained. In this type of teaching style of each person in each academic field, and each job can be arbitrary in time and space, trained without having to leave the house for work or business is education. This method requires that students are dispersed over long distances provides. Distance learning advantages of distance education in comparison with traditional education, the need for physical locations and training programs limited to no specific time period. In this type of teaching style, learning for life without possibility of spatial and temporal constraints for each individual there. In distance education, problems related to lack of qualified teachers and appropriate educational environment - as it posed in the traditional method of M is - is resolved. In this way the use of advanced features in digital libraries and search the various sites during the study, time and cost savings are.

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### Online Classes VS Traditional Classes: Comparison between the Two Methods

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**Abstract:** There are two types of programs offered by distance education schools: synchronous learning programs and asynchronous learning programs. With synchronous learning, distance education students must log on to the school's website at a set time. Often, they interact with their peers and professors via group chats, web seminars, video conferencing, and phone call-ins. With asynchronous learning, distance education students complete all coursework on their own time. They often learn via assignment sheets, message boards, email, pre-recorded video lectures, mp3s, and traditional mail correspondence.

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**Keywords:** Online Classes, Traditional Classes, distance education

#### Introduction:

When the standardization and the requirements for training by the third millennium will be talking, unconscious form, design and construction to provide context and use tools and indicators to teaching the principles of community-based knowledge to the mind is centered. . No doubt these requirements and identify the correct tools and proper utilization of their functions according to accelerate the development expected in the knowledge-based information society will be effective. Such concerns and problems that any country in its development plans in motion to the information becoming a knowledge based society means a society would be faced with the centrality of knowledge, Dealing with existing tools and how these tools are used.

Led the way when dealing with those massive training programs available to speak to the technological tools that we expect to occur that planners and decision makers that planners and decision makers of large structures, especially university education according to the image Access to the development of community information are available on these tools are selected and used.

Massive wave of data produced in today's world it nicknamed the "information age" has all day and through various means of communication in the world will move on its size are added. Other hand, as we're not the world witnessed the development of the role of information communication devices transporting feedback fast and absorb the information around the world, we forget

Therefore, information and communication as the main lever or two important move in developing wings, we learn. Meanwhile, proper utilization of the capacities of these two valuable and effective indexes in the general development concept for any society

and the principles of a critical need is considered. With a view to clarifying this issue can be paid in the best way to create a platform for developing data standards and access to a knowledge based society, what really can be. To achieve a clear and practical answer in this area before all the existing definitions and indicators mentioned placed.

#### WHAT IS DISTANCE EDUCATION?

Distance education is a method of education in which the learner is physically separated from the teacher and the institution sponsoring the instruction. It may be used on its own, or in conjunction with other forms of education, including face-to-face instruction. In any distance education process there must be a teacher, one or more students, and a course or curriculum that the teacher is capable of teaching and the student is trying to learn. The contract between teacher and learner, whether in a traditional classroom or distance education, requires that the student be taught, assessed, given guidance and, where appropriate, prepared for examinations that may or may not be conducted by the institution. This must be accomplished by two-way communication. Learning may be undertaken either individually or in groups; in either case, it is accomplished in the physical absence of the teacher in distance education. Where distance teaching materials are provided to learners, they are structured in ways that facilitate learning at a distance.

## Pros and Cons of Online Classes: Advantages and Disadvantages of Online Courses

Distance learning is a hot subject today, but is it really for you? It is best not to hurry when choosing a college or university, lest you find yourself a victim of hype. Online courses are a new revolutionary way of providing education. Even traditional institutions are increasingly incorporating the Internet e-learning online interaction means and software tools into their programs.

### What do the education institutions offer?

Archived video footage and virtual real-time lectures, online assignments and presentations, electronic academic material, multimedia as part of classrooms – all these have been part of higher education for a while now.

However, Online Education means taking entire degree program online, via your laptop. This means an entirely new experience, yet not everybody is ready for it.

Taking Online Classes via Online education program requires specific learning skills, which some people lack.

### The Pros of Online Classes

The key advantages of using an online class are –

#### 1. Time flexibility

For some people there is nothing worse than getting up before 9 in the morning. Traditional higher education often requires just that. But with online education students have the possibility to adjust schedules to their life, rather than adjust their life to predetermined schedules. Other people benefit greatly from it too: parents, full-time employees, and anyone else who for this or that reason is too busy to attend traditional classes.

#### 2. Geographic flexibility

Online institutions make possible something unprecedented: it no longer matters where you live. You can live in one of the world and study daily at an institution based in another without ever leaving your

native country, or even your room, for that matter. Even in terms of local travel online education is a revolution: there are no more bus, train, or car trips, no traffic jams, no being late for the bus/train, no time and money spent on travel.

#### 3. Class Notes

Not everybody knows how to write great class notes. Online courses provide electronic transcripts of every lecture. This is great for anyone who has short attention spans or does not like to write during lectures.

#### 4. More educational means

Much more so that in traditional classrooms, online education incorporates online multimedia possibilities into instruction.

### Possible cons of online classes include:

What are the Disadvantages of Online Courses? Here are some –

#### 1. Credits:

Not all online course credits are transferable to traditional degree programs!

#### 2. Require self-discipline

Excellent self-discipline and time management without the aid of strict schedules, attendance requirements, and personal communication

#### 3. Lack of interpersonal interaction

No interpersonal relationships with either teachers or students; only via email, message boards, and other online means of communication.

### Disadvantages of Online Classes: Disadvantages to Consider

This article will focus on the disadvantage of taking Online Classes. Online education is not exactly a trend yet, but it is becoming increasingly popular.

The reason for this is that it offers new opportunities where none existed before – Many people wouldn't have been able to acquire the necessary higher education without it. However, like all things in life, taking Online Classes has some drawbacks and disadvantages as compared to the traditional classrooms.

That said, online classes are not perfect for everyone. To avoid getting caught in the hype and making the wrong decision, consider the pros and cons of online education.

### **Taking Online Classes – Disadvantages**

Let us review the weaknesses –

#### **1. Lack of Socializing**

Taking courses through the net completely erases the concept of socializing. Although there are online class discussions in online education, it is still not always an easy way to interact. This method completely eliminates the possibility to meet classmates face to face in and outside the classroom.

#### **2. Lack of Close Personal Contact with Teachers**

Besides being unable to socialize with other students, there is no way to arrange personal face-to-face meetings with the teachers. This, too, can be a significant disadvantage for those students who are motivated by close personal connection, discussion, and advice. Online tutorials definitely do not provide this vital touch and online discussions may not be intimate enough to provide the same powerful stimulus.

#### **3. Classroom Attendance – None**

This may sound like a good thing to some, but for many this is a major flaw of the online system. Some simply cannot focus on their own, while sharing an actual room with other motivated students right in front of them is a great incentive to concentrate and understand. Others simply love the atmosphere of campus classrooms and would never give them up.

#### **4. Self-Discipline**

Studying via the net from home means you have more freedom and more responsibility for managing your time and effort. It is important to know that you are able to invest enough effort into studies without the stricter discipline imposed by traditional institutions and without their added incentives of classroom attendance and personal meetings.

#### **5. Accessibility**

Most people would have no problem accessing online education and that is one of its major plusses. Still, some simply do not have the required Internet connectivity (the required bandwidth for taking online class) or no personal computer they could comfortably use for prolonged private study sessions.

For these people campus-based courses are actually much better, since they provide an environment for group and individualized study: classrooms, offices, libraries, etc.

#### **6. Accreditation and Employment**

This is one of the most serious aspects of the online education.

It is still an emerging system and many authorities and employers officially do not recognize many online diplomas. Moreover, even if a degree is from an officially accredited online institution, many employees still prefer candidates with traditional degrees.

### **Advantages of Online Classes: Benefits of Online Classes**

Imagine a future without campuses and classrooms. Instead there will be academic cyber-space and scholarly chat rooms. Accredited academic programs world-wide will be given via the Internet, producing an unprecedented global number of world experts in every field.

This is not yet the case today, but online schools are already offering great opportunities where none existed only a few years ago.

Higher education is becoming easily available to people who would otherwise never even dream of it – Adults who work full time, family people, people

from remote countries all over the world converging in world-class learning centers.

Because online education is still a new field, it is important to know exactly what it can and cannot offer you.

### **What are the benefits of online classes? Advantages of taking Online Classes**

Some of the Pros of enrolling to Online Education and taking online courses:

#### **1. General Convenience**

Generally speaking, online classes are more convenient since you do not need to leave home to take them. Time table is flexible and there is generally more freedom. It is also simply convenient to be able to study anywhere while being able to do many of the required things almost any time of the day, like on the train when going home from work.

#### **2. Time Considerations**

Online courses save a lot of valuable time, especially if you are an adult with a career and a family to take care of. Basically, you log on to the class/course site and you are “at the university” – no need to take long rides back and forth or trudge from one end of the campus to another (and some campuses can stretch across an entire city and require bicycles or buses).

#### **3. Online Teaching Possibilities – New cutting edge technologies**

Online classes offer many innovative possibilities of communication.

Where in a traditional classroom everything would have to be done in face to face interactions, which has its advantages but is also often inconvenient or simply impossible (for some).

An online class environment eliminates certain boundaries and constraints, allowing easy near-instant access to information, resources, libraries, extensive photo and video archives, and personal meetings compressed, through the power of the Internet, from hours to minutes.

#### **4. Whom Online Class Suits Best**

- Disciplined students with excellent time management skills who do not need teachers and strict predetermined programs to do their best.
- Students who wish to study in a specific country or institution which is otherwise not accessible to them (geographic convenience).
- Students who cannot afford traditional education – Online schools are generally less expensive.
- Students who dislike campus requirements. Although for many, the campus life is the best time of their life, some people prefer the privacy of their homes. Online education is ideal for them.
- Students who cannot afford traditional education due to busy professional or personal schedules.

### **Online Classes VS Traditional Classes: Comparison between the Two Methods**

Nowadays it is not enough to choose the university you want to learn at. Today, you have to first decide whether you want an online degree or an offline/traditional education.

Online education is a growing force in the field of additional and higher education. It is probable that in the near future, within a decade or two, online education will be the global standard.

Considering the differences between these two methodologies of education can provide you the basic knowledge and even surprising opportunities.

#### **Online VS Traditional Classes**

##### **Attendance**

Traditional institutions require physical presence and participation in classrooms. This entails extensive travel and expenses. For many only this already makes higher education impossible. Online education requires no traveling at all, saving



time, money, and energy. Busy people will therefore be able to combine extensive studies with work and family. Education is available to sailors on submarines and to astronauts in space!

### **Virtual classrooms vs. real classrooms**

There are two camps around this issue – Those who love attending campus-based lecture and those would rather stay at home. Virtual education means there are no campuses and no classrooms. For those who prefer to be at home and are comfortable with cyberspace this is a virtual paradise. For those who are technophobic, get confused by online multi-media, and who prefer direct human contact this may be a veritable digitalized hell. But the amount of people who are uncomfortable with technology and the internet is decreasing exponentially. Most people are addicted to the internet. And video communication is becoming standard nowadays, allowing top-quality group video communication online.

### **Traditional and Online Schedules**

Online institutions deliver many or all courses via modules.

These modules can be scheduled by the student him or herself to be taken virtually at any time of day or night. This is obviously impossible with traditional classes, however requires a high degree of self-motivation and the ability to meet requirements while enjoying greater freedom.

### **The Value of online classes/degree earned as compared to the traditional ones**

When it comes to quality, going to Online Classes becomes universal as going to a traditional college class.

One has to remember that the world is changed rapidly and the online education is now a great alternative to the traditional one. Just like a person got used to choose between campus-based colleges and universities, today the online education grows to be an option. Of course, with its different varying quality of degrees, just like any on-campus degrees.

### **Taking Online Classes? Why Take Online Classes?**

If you are trying to figure out which type of course you should enroll for, then considering an online degree might be of help.

However, we would not advice you to jump on an online course without considering the advantages, for it is important to be aware and well informed before taking online courses.

Once you are aware of the advantages of online courses, you would surely realize the value of our advice.

### **The benefits of Taking Online Courses: Why should you take it Online?**

Let us consider the advantages of taking online classes:

#### **1. Recognition:**

First things first, online courses are widely accepted and sought after by employers. It is not something that people shun away from. In fact, a research conducted by DETC has revealed that more than 70% of employers look forward to recruiting people who possess online degrees rather than their traditional counterparts.

#### **2. Being your own boss:**

Traditional education requires teachers to impart education to students and monitor and evaluate their performances as well. If you are one of those who hate being nagged by someone, then online courses are meant for you. You can study on your own and keep yourself motivated without the interference of any one.

#### **3. Accessibility and comfort:**

Online courses are a respite for all those who hate functioning in a preplanned and methodical way.

Online classes enable students to study whenever they want to and from where ever they can. They can study from within the comforts of their homes. Further, online courses suit working professionals the most.

#### **4. Reading and not listening:**

Online courses require students to study referring to online textual content sent by universities. Thus, they can escape the monotonous lectures and long classrooms hours yet be well acquainted with the study materials.

#### 5. Individualistic minds at work:

Online courses are the best for those who hate social interactions and love to be on their own. The courses alienate all sorts of distractive elements that may be present in a traditional classroom. Thus, a student can enjoy his/her peace of mind.

#### 6. Resource center:

Online courses enable students to refer to notes or relevant study material by visiting the archived section. This is not so in traditional classrooms. If a student misses a class lecture, he/she misses the study content as well.

You would now surely agree that **accredited online courses** have the same worth as the traditional ones.

#### Conclusion:

Distance education delivers classes (live or pre-taped) to students in their home, office, or classroom. It is used by K-12, higher education, continuing education and business. As the cost of delivering quality education increases, institutions find that limited resources prevent them from building facilities, hiring faculty, or expanding curricula. They are using distance education to maximize resources and are combining their assets with others to produce programming. Distance education is offered internationally, nationally, regionally, and locally over all forms of conferencing technology.

Distance learning is expanding and examples of it are increasing dramatically. Fewer than 10 states were using distance learning in 1987; today, virtually all states have an interest or effort in distance education. Distance learning systems connect the teacher with the students when physical face-to-face interaction is not possible. Telecommunications systems carry instruction, moving information instead of people. The technology at distant locations are important and affect how interaction takes place, what information resources are used, and how effective the system is likely to be.

Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home.

The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.

Interactivity is accomplished via telephone (one-way video and two-way audio), two-way video or graphics interactivity, two-way computer hookups, two-way audio. Interactivity may be delayed but interaction provided by teacher telephone office hours when students can call or through time with on-site facilitators. Classes with large numbers of students have a limited amount of interactivity. Much of the activity on computer networks is on a delayed basis as well. Possibilities for audio and visual interaction are increasingly wide.

Challenges which faced the early users of distance education are still with us today. If distance education is to play a greater role in improving the quality of education, it will require expanded technology; more linkages between schools, higher education, and the private sector; and more teachers who use technology well. Teachers must be involved in planning the systems, trained to use the tools they provide, and given the flexibility to revise their teaching. Federal and state regulations will need revision to ensure a more flexible and effective use of technology. Connections have been established across geographic, instructional, and institutional boundaries which provide opportunities for collaboration and resource sharing among many groups. In the pooling of students and teachers, distance learning reconfigures the classroom which no longer is

bounded by the physical space of the school, district, state or nation.

The key to success in distance learning is the teacher. If the teacher is good, the technology can become almost transparent. No technology can overcome poor teaching which is actually exacerbated in distance education applications. When skilled teachers are involved, enthusiasm, expertise, and creative use of the media can enrich students beyond the four walls of their classroom.

Teachers need training in the system's technical aspects and in the educational applications of the technology. Areas for assistance include the amount of time needed to prepare and teach courses, how to establish and maintain effective communication with students, strategies for adding visual components to audio courses, ways to increase interaction between students and faculty, planning and management of organizational details, and strategies for group cohesion and student motivation.

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3/28/2011

**The role of ICT in distance education**<sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh<sup>1,2</sup> Department of Environment, Damavand Branch, Islamic Azad University, Damavand, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** Challenges which faced the early users of distance education are still with us today. If distance education is to play a greater role in improving the quality of education, it will require expanded technology; more linkages between schools, higher education, and the private sector; and more teachers who use technology well. Teachers must be involved in planning the systems, trained to use the tools they provide, and given the flexibility to revise their teaching. Federal and state regulations will need revision to ensure a more flexible and effective use of technology. Connections have been established across geographic, instructional, and institutional boundaries which provide opportunities for collaboration and resource sharing among many groups. In the pooling of students and teachers, distance learning reconfigures the classroom which no longer is bounded by the physical space of the school, district, state or nation.

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**Keywords:** ICT, distance education

**Introduction:**

The background of distance education to mid-nineteenth century dates. Pioneers in America and Europe of the best distance learning technologies for training that day, took advantage. For example: mailing system for creating educational opportunities for those able to go to regular schools were not interested in science education, but had been used. Of course at that time most of those who took advantage of this type of Physically Handicapped facilities, women allowed to attend the classes along with men who did not have a. Location is N. There was a school; were. One of the pioneers in this field English personal name was Isaac Pitman. His short-term training through correspondence and the correspondence began in 1840 in England. Students were required to read the Bible a part of written questions and answers raised by Pittman to get a good score should return by mail.

But distance education in America and for the first time at the University of Illinois Veslin was implemented in 1874. In 1900, university education through correspondence, face became more public. National Association of Home Education in 1926 and led the establishment of distance education and related programs in universities and schools, and more important aspect to find drivers. Education in 1920 invented the radio and TV appearance in 1940 led to important new techniques in communications that the nature of the field of distance education also created dramatic changes.

Trainers using these new technologies were successful educational programs to millions seek learning opportunities and thereby reach out to the educational spaces, training centers to expand. With the development of long-distance telephone system in the early twentieth century method of capacity and

distance learning methods for students to access educational opportunities in the world increased Translation. But until the invention of mobile tele conference ever in the 80 and 90 and the main role in the concept of distance education did not play. Telemetry system, allowing for teachers conference provided that without the slightest delay at a time when your students can listen to them talk and sometimes they see.

Expansion of computer networks in the decade 1990 and connect millions of people through lines to the telephone networks made it possible to simply distance learning via computers and computer conferences around the world is possible (a) and Today with the development of control technology in science and technology around the world are.

**WHAT IS DISTANCE EDUCATION?**

Distance education is a method of education in which the learner is physically separated from the teacher and the institution sponsoring the instruction. It may be used on its own, or in conjunction with other forms of education, including face-to-face instruction. In any distance education process there must be a teacher, one or more students, and a course or curriculum that the teacher is capable of teaching and the student is trying to learn. The contract between teacher and learner, whether in a traditional classroom or distance education, requires that the student be taught, assessed, given guidance and, where appropriate, prepared for examinations that may or may not be conducted by the institution. This must be accomplished by two-way communication. Learning may be undertaken either individually or in



groups; in either case, it is accomplished in the physical absence of the teacher in distance education. Where distance teaching materials are provided to learners, they are structured in ways that facilitate learning at a distance.

#### **Benefits of Distance Learning:**

Benefits and opportunities that distance education provides, include:

- training a wide range of audiences.
- meet the needs of students and students who can not attend in place.
- Possible connection between students and students with cultures, beliefs and experiences are different.
- Benefiting from coaches and speakers who do not live in the country.

#### **Remote educational tool:**

distance learning tools and supplies various uses. These tools in four main courses are:

##### **A - Audio Tools:**

Audio tools include training such as two-way interactive telephone, video conference, shortwave radio and a strain of tools such as audio tape and radio.

##### **B - Image tools:**

including slides, films, video tapes and video conferences.

##### **C - Data:**

computers as electronic data are sent and received. Because the data word description for a wide range of educational tools is used.

Computer applications for distance education are varied and include the following:

- 1- Training to Computer Management.
- 2 - Computer Assisted Instruction.
- 3 - through PCs.
- 4 - e-mail, telegraph, computer conference and the World Wide Web simultaneously.

##### **D - Print:**

The main element of distance education programs, particularly in the exchange and delivery system information tools are considered.

#### **Key factors in the process of distance education:**

the process of remote training, the following factors contribute:

- Students:  
Regardless of educational content, role and main element in the learning process students are responsible.
- Coaches and Teachers:

Success depends on a lot of educational activities the ability, skills and knowledge are the coaches and professors.

##### **- Facilitators of communication:**

Facilitator bases, as the bridge between students and mentors are. Must base expectations of teachers and educational needs of students and service coordination and communication to create.

##### **- Support staff:**

One of the important pillars of any development of distance education programs, by development group finds. Operational support staff such as student registration, copy and distribute their resources, order textbooks, security and copyright, and are responsible for the report.

##### **- Management:**

The group decision makers, builders and judges are considered to be educational and should be considered among the factors above, establish the correct relationship formation.

#### **Types of Distance Education Programs:**

There are two types of programs offered by distance education schools: synchronous learning programs and asynchronous learning programs. With synchronous learning, distance education students must log on to the school's website at a set time. Often, they interact with their peers and professors via group chats, web seminars, video conferencing, and phone call-ins. With asynchronous learning, distance education students complete all coursework on their own time. They often learn via assignment sheets, message boards, email, pre-recorded video lectures, mp3s, and traditional mail correspondence.

Distance education began for the delivery of courses to students who live in remote areas. Over the years, though, this form of education has become the preferred method for learning outside of the classroom.

Distance Education is now undertaken by people with busy schedules, hectic lifestyles, special needs, and also those living in isolated areas. What's more, with such flexible learning options you can choose to study at any time and from any location you like.

There are a number of different **forms of distance education** and it's important to know which method you prefer:

- **Correspondence learning:** your course materials are printed and sent out to you by mail/courier. The advantages are that you have a printed set of reference materials, you can study anywhere and you are not reliant on a computer, you can learn for long periods of time.
- **eLearning:** your course materials are provided to you in multimedia format; that is, on CD/DVD. In this way you can choose to take your study materials within you and learn anywhere in the world with just a laptop.
- **Online learning:** no materials are sent to you and you do all your learning online. The limitation is that you need to be logged onto a computer (though you may be able to download and print some of your materials yourself, though this can cost you more in ink), there is a limit to how much you can absorb and do online, and most people's attention span on-screen is limited to 20 minutes (your eyes get tired after that).
- **Broadcast learning:** where you tune into a series of television, radio or Internet broadcasts (e.g. podcast, YouTube, etc.).
- **Teleconferencing:** where your lessons are conducted in real time through an Internet connection. Limitations are that streaming can be slow, connections can cause problems (students and teachers generally need to be computer literate) and there can be delays in talk-time, depending on software, hardware and connection capabilities.

### Conclusion:

Distance education delivers classes (live or pre-taped) to students in their home, office, or classroom. It is used by K-12, higher education, continuing education and business. As the cost of delivering quality education increases, institutions find that limited resources prevent them from building facilities, hiring faculty, or expanding curricula. They are using distance education to maximize resources and are combining their assets with others to produce programming. Distance education is offered internationally, nationally, regionally, and locally over all forms of conferencing technology.

Distance learning is expanding and examples of it are increasing dramatically. Fewer than 10 states were using distance learning in 1987; today, virtually all states have an interest or effort in distance education. Distance learning systems connect the teacher with the students when physical face-to-face interaction is not possible. Telecommunications systems carry instruction, moving information instead of people. The technology at distant locations are important and affect how interaction takes place, what information resources are used, and how effective the system is likely to be.

Technology transports information, not people. Distances between teachers and students are bridged with an array of familiar technology as well as new information age equipment. What sets today's distance education efforts apart from previous efforts is the possibility of an interactive capacity that provides learner and teacher with needed feedback, including the opportunity to dialogue, clarify, or assess. Advances in digital compression technology may greatly expand the number of channels that can be sent over any transmission medium, doubling or even tripling channel capacity. Technologies for learning at a distance are also enlarging our definition of how students learn, where they learn, and who teaches them. No one technology is best for all situations and applications. Different technologies have different capabilities and limitations, and effective implementation will depend on matching technological capabilities to education needs.

Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home.

The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems

are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.

Interactivity is accomplished via telephone (one-way video and two-way audio), two-way video or graphics interactivity, two-way computer hookups, two-way audio. Interactivity may be delayed but interaction provided by teacher telephone office hours when students can call or through time with on-site facilitators. Classes with large numbers of students have a limited amount of interactivity. Much of the activity on computer networks is on a delayed basis as well. Possibilities for audio and visual interaction are increasingly wide.

In the earlier days of distance learning, it was most common to see distance learning used for rural students who were at a distance from an educational institution. The student might watch a telecourse on a television stations, read texts, mail in assignments and then travel to the local college to take an exam. This model is still in use, but as the technology has become more sophisticated and the cost of distance learning dropped as equipment prices dropped, the use of distance education has increased.

High front-end costs prevented an early widespread adoption of electronically mediated learning. Distance learning has been aggressively adopted in many areas because it can meet specific educational needs. As the concept of accountability became accepted and laws required certain courses in high school in order for students to be admitted to state colleges, telecommunications was examined as a way to provide student access to the required courses. Many rural school districts could not afford the special teachers to conduct required courses. Distance education met this need by providing courses in schools where teachers were not available or were too costly to provide for a few students. It also fulfilled a need for teacher training and staff development in locations where experts and resources were difficult to obtain. These systems link learner communities with each other and bring a wide array of experts and information to the classroom.

Challenges which faced the early users of distance education are still with us today. If distance education is to play a greater role in improving the quality of education, it will require expanded technology; more linkages between schools, higher education, and the private sector; and more teachers who use technology well. Teachers must be involved in planning the systems, trained to use the tools they provide, and

given the flexibility to revise their teaching. Federal and state regulations will need revision to ensure a more flexible and effective use of technology. Connections have been established across geographic, instructional, and institutional boundaries which provide opportunities for collaboration and resource sharing among many groups. In the pooling of students and teachers, distance learning reconfigures the classroom which no longer is bounded by the physical space of the school, district, state or nation.

The key to success in distance learning is the teacher. If the teacher is good, the technology can become almost transparent. No technology can overcome poor teaching which is actually exacerbated in distance education applications. When skilled teachers are involved, enthusiasm, expertise, and creative use of the media can enrich students beyond the four walls of their classroom.

Teachers need training in the system's technical aspects and in the educational applications of the technology. Areas for assistance include the amount of time needed to prepare and teach courses, how to establish and maintain effective communication with students, strategies for adding visual components to audio courses, ways to increase interaction between students and faculty, planning and management of organizational details, and strategies for group cohesion and student motivation.

The interchange of ideas requires different communication methods than in conventional classrooms: information technologies are predominantly visual media, rather than the textual and auditory environment of the conventional classroom, the affective content of mediated messages is muted compared to face-to-face interaction, and complex cognitive content can be conveyed more readily in electronic form because multiple representations of material (e.g., animations, text, verbal descriptions, and visual images) can be presented to give learners many ways of understanding the fundamental concept.

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**The role of online Learning in improving education**<sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh<sup>1,2</sup> Department of Agriculture and Natural Resource, Mahabad Branch, Islamic Azad University, Mahabad, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** In its original form, teachers using distance education traveled to remote sites and taught a class, or corresponded with students through mail, telephone, or fax machine. Individualized study has been a method of reaching the remote student for some time. Detailed course instructions are sent to the learner who performs the assigned tasks and returns the completed work to the teacher for evaluation and reassignment if necessary. Technology has raised the quality of individualized distance instruction. The use of various forms of electronic media increases time effectiveness and improves the delivery of information. Video, audio, and computer-based applications may enhance the product received by the independent learner. Electronic delivery can occur using synchronous communication, in which class members participate at the same time, or asynchronous communication where participants are separated by time.

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**Keywords:** online Learning, education

**Introduction:**

The background of distance education to mid-nineteenth century dates. Pioneers in America and Europe of the best distance learning technologies for training that day, took advantage. For example: mailing system for creating educational opportunities for those able to go to regular schools were not interested in science education, but had been used. Of course at that time most of those who took advantage of this type of Physically Handicapped facilities, women allowed to attend the classes along with men who did not have a. Location is N. There was a school; were. One of the pioneers in this field English personal name was Isaac Pitman. His short-term training through correspondence and the correspondence began in 1840 in England. Students were required to read the Bible a part of written questions and answers raised by Pittman to get a good score should return by mail.

But distance education in America and for the first time at the University of Illinois Veslin was implemented in 1874. In 1900, university education through correspondence, face became more public. National Association of Home Education in 1926 and led the establishment of distance education and related programs in universities and schools, and more important aspect to find drivers. Education in 1920 invented the radio and TV appearance in 1940 led to important new techniques in communications that the nature of the field of distance education also created dramatic changes.

Trainers using these new technologies were successful educational programs to millions seek learning opportunities and thereby reach out to the

educational spaces, training centers to expand. With the development of long-distance telephone system in the early twentieth century method of capacity and distance learning methods for students to access educational opportunities in the world increased Translation. But until the invention of mobile tele conference ever in the 80 and 90 and the main role in the concept of distance education did not play. Telemetry system, allowing for teachers conference provided that without the slightest delay at a time when your students can listen to them talk and sometimes they see.

Expansion of computer networks in the decade 1990 and connect millions of people through lines to the telephone networks made it possible to simply distance learning via computers and computer conferences around the world is possible (a) and Today with the development of control technology in science and technology around the world are.

**Definition of distance learning:**

in distance education teachers often are separate and comprehensive. Preparation of educational materials, supporting learners under the supervision of a training center takes place almost never do as a group are not. For services to education and electronic learning aids such as printed materials, computers and the Internet rely on.

Another look at the educational system of a new e-business and artistic and is a comprehensive solution to the institutions that want to move in the direction that technology and change their teaching methods and environments are possible to achieve the new educational approach provides.

**Benefits of Distance Learning:**

Benefits and opportunities that distance education provides, include:

- training a wide range of audiences.
- meet the needs of students and students who can not attend in place.
- Possible connection between students and students with cultures, beliefs and experiences are different.
- Benefiting from coaches and speakers who do not live in the country.

**Key factors in the process of distance education:**

the process of remote training, the following factors contribute:

- Students:

Regardless of educational content, role and main element in the learning process students are responsible.

- Coaches and Teachers:

Success depends on a lot of educational activities the ability, skills and knowledge are the coaches and professors.

- Facilitators of communication:

Facilitator bases, as the bridge between students and mentors are. Must base expectations of teachers and educational needs of students and service coordination and communication to create.

- Support staff:

One of the important pillars of any development of distance education programs, by development group finds. Operational support staff such as student registration, copy and distribute their resources, order textbooks, security and copyright, and are responsible for the report.

- Management:

The group decision makers, builders and judges are considered to be educational and should be considered among the factors above, establish the correct relationship formation.

**Adaptability:**

Distance education can be used for some aspects of most disciplines. For example, several institutions of higher education already have developed certificate programs, undergraduate programs, and graduate programs in health and physical education that are delivered using distance education methods. Eastern Oregon University, Emporia State University, Kutztown University, LaSalle University, the Medical College of Wisconsin, University of Wisconsin at Stevens Point, and Virginia Tech are

among institutions integrating distance technology into their physical education programs.

Traditional programs that are heavily based in skill development and demonstration or require laboratory work can be offered in a distance education framework using interactive video interfaced with computers to facilitate a hands-on learning approach at a distance. Classes that use lecture and laboratory experiences are easily adapted to a distance education situation. Course materials, including animals for dissection, are sent to class participants with video and written instructions and assignments.

**EFFECTIVE TEACHING AND LEARNING WITH DISTANCE EDUCATION**

Distance education dictates changes in behavior for both the teacher and the learner. The successful student develops persistence and skills in self-directing work. The successful distance education teacher becomes conversant with new technology and develops new instructional styles, moving from creating instruction to managing resources and students and disseminating views (Strain, 1987). Administrative and faculty support for distance education are critical to the success of this instructional method. Administrators should take note that the implementation of a distance education program may allow access to a greater number of students. However, the time and work associated with teaching at a distance exceeds the normal requirements of campus-based instruction.

Students in distance education settings perform as well or better on assignments, class activities, and exams when compared to campus-based students (St. Pierre, 1998). Nevertheless, students must maintain persistence and a clear focus to succeed in a distance learning situation. Self-direction, a passion for learning, and strong individual responsibility are important influences on achievement. There are indications that distance education works best for more mature, motivated, well-organized, and already accomplished learners (Rintala, 1998).

Garrels (1997) describes five critical elements for successful teaching at a distance:

1. Instructor enthusiasm. This requires animation and comfort in front of the camera, or with the

technology utilized. Faculty support and interest are critical to the success of distance learning endeavors.

2. Organization. Teaching materials must be prepared in advance; timing, variation, and smooth transitions must be planned. Instructors should allocate from 3 to 5 hours of preparation for each hour of distance instruction. Great attention to detail is required long before the actual classroom activity occurs (Summers, 1997).

3. Strong commitment to student interaction. Whatever the modality used to teach at a distance, the instructor must encourage and facilitate ongoing communication between the students and the instructor.

4. Familiarity with the technology used in the class format. Faculty development is important before beginning any distance activities, and instructors should be trained in video use, computer use, or other forms of instructional technology used.

5. Critical support personnel. Production staff, graphic designers, and technical staff members will help the instructional setting produce successful teaching at a distance.

### **What is online Learning? Definition of Online Learning:**

The main principle of Online Learning – also called e-learning, distance learning, etc – is very simple: Online Learning allows students to remain at home or anywhere they like and still be able to study, nowadays mostly via computers and the Internet.

But the cultural implications of this simple thing are vast and unprecedented in the history of civilization.

### **What online learning is all about?**

Let us define the main aspects of online learning -

### **How Online Learning Works?**

The principle simple: Online Learning works like traditional education, but happens entirely online. Lectures are viewed on the screen of a computer, with written supplementary material, lecture transcripts, and academic sources provided

electronically.

There is email and forum communication between classmates and teachers, as well as video meetings.

Exams are taken online, assignments are submitted electronically (uploaded or sent by email). Some institutions still require exams to be taken in special learning centers, but this is most likely to change over time to total virtual education experience.

### **What Online Learning can offer?**

- Students no longer need to work in snatches during summer vacations, they can combine more easily then ever before full time jobs and studies
- Students do not need to commute, saving great amounts of time, money, and personal energy, as well as global energy.

This seems very simple, and it is, but its implications are, again, enormous. It means much more time spent on actual education and personal life. It means money saved. It even means significantly less traffic and green house gasses.

It also means students:

- Construct their own schedules
- Can finish four-year programs in two years

### **Education and Salary:**

Education has always meant higher salary and better living in the modern civilized world. But to combine work and education has always been difficult, for many – impossible. Online Learning is now making it possible for anyone with the desire to learn, acquire any form of education, including doctoral degrees from major institutions, online. Busy people are combining right now their busy professional and family lives with higher degree education, enabled by the unprecedented flexibility of online learning.

Whoever had no career at all before, now can start it, despite time constraints. Whoever already has a career, can improve it or change it entirely.

### **Disadvantages of Online Education: Drawbacks to Consider**

This article reviews the main disadvantages of the online education. As online services in general are revolutionizing Internet activity and the business industry – Online Education is becoming increasingly popular.

It is not merely a new trend – for many people it is the only convenient way to acquire education. Online education already provides unique new opportunities which hadn't exist before.

The distance/online Education has not come to replace Traditional Education yet. The number of online universities and colleges is still relatively small and their services are not as well established as the services of traditional institutions.

### **Online Education – Disadvantages**

The following are its 4 main drawbacks one would want to consider -

#### **1. Human Interaction**

Online classes means there is not live, face-to-face classroom and office interaction between students and teachers. For many this is highly significant. Consulting lecturers in person and being able to discuss matters in groups, in and outside the class is, for many, an important motivational activity and learning strategy. Moreover, for many programs interpersonal communication is crucial, but it is not easy to seriously practice online. Many people also prefer traditional campus-based education simply for the on-campus atmosphere and the opportunity to meet many people there face-to-face between and during class, conferences, campus parties, concerts, fairs, and various cultural events.

#### **2. Study Materials**

Online institutions provide all or much of their material online, which may be convenient, since you have to buy and photocopy less. But while online information in general is, of course, extensive, approved and trusted scholarly academic material is not easily to be found online.

The resources of online universities and colleges are not yet as extensive as those of traditional institutions with their on-campus libraries (and the private libraries of generous lecturers who will always lend you that hard-to-find book you absolutely must have for your paper).

#### **3. No Lab Sessions:**

Degrees science, especially the natural sciences, require lab hours. Online education as yet cannot provide a substitute for actual hands-on experience that students find in the labs on campus. Such experience is crucial in general, and it is often noted in particular by employees. One reason why graduates from traditional institutions are preferred is that they have extensive and relevant lab experience.

#### **4. Difficulties of Self-Discipline:**

For many a significant advantage of traditional education is that it leaves little room for procrastination. You have to show up on campus and be in class, and for many this is a great motivational aspect and the reason for their eventual success.

With online education the student has much more freedom. This can be both an advantage and a disadvantage. For many it is a disadvantage because it encourages procrastination. This leads either to unnecessarily prolonged studies or even failure to fulfill requirements, simply because there was too much freedom.

### **Conclusion:**

In general, new methods of educational systems to countries around the world as a necessity and need for learning and training opportunities to study in areas with different climatic features and conditions of learning and education according to their gender and cultures, has been. Each method is mentioned with regard to changes in features and creates an education system, and evaluation is used. Judgement of distance education in an educational way, first as a necessity to eliminate barriers to educational climate and geographical areas, age and gender restrictions learners began their work And more in a death education system, especially in the philosophy and goals based on theories of learning theories have evolved to find and promote professional growth. Approach to distance education with regard to the necessity of education in countries formed. Emergence and development of information societies is the consequences of industrialization. Despite the

diversity of information in various forms of media in local, national and international, access, exchange and use of various information easier than last time is. Information society, a member of your buddies know that open information system in terms of geographical location and the last 25 years, organizational development, are limited. Distance learning faster than other forms of training has been. Growth factor in the economic interests of this type of educational approach, flexibility and remove the distance can be named. The methods of distance education, required for building physical education is not providing services. Teachers and trainers in this method - compared with traditional methods - and have more opportunities to more people than are being trained. In this type of teaching style of each person in each academic field, and each job can be arbitrary in time and space, trained without having to leave the house for work or business is education. This method requires that students are dispersed over long distances provides. Distance learning advantages of distance education in comparison with traditional education, the need for physical locations and training programs limited to no specific time period. In this type of teaching style, learning for life without possibility of spatial and temporal constraints for each individual there. In distance education, problems related to lack of qualified teachers and appropriate educational environment - as it posed in the traditional method of M is - is resolved. In this way the use of advanced features in digital libraries and search the various sites during the study, time and cost savings are.

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## Unified Scheduling of Pumped-Storage and Hydro-Thermal Units Based on Game Theory

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**Abstract:** Determining the main strategies in a country is performed with a long-term planning in order to reach sustainable development. Energy category and its delivery have more influence on economic and political development; thus, optimal scheduling should be performed in a way that considers mentioned attribute with comprehensive approach. Energy delivery and its efficiency increase in recent century and considering Next generation needs and their contribution in existing resources are contemplated as a significant challenge. Water is the most important natural resource in the World and it is vital to use these resources in an optimal way because of environmental issues and also political, economic, social issues, etc. One way to control and rein of surface water is to build dams on rivers. The dams are built for various reasons, but most serve multiple purposes: flood control power generation, irrigation, diversion, pisciculture, urban water reservoirs, livestock watering, and etc. The electric energy generation in majority of enormous dams is considered as a green power source with high efficiency. This paper introduces a new approach in order to control the existing fountains using pumped-storage systems based on game theory.

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**Keywords:** Energy Market, Cournot Model, Game Theory, Pumped-storage Unit

### 1. Introduction

Rising fossil fuel costs and concerns about the environmental impact of burning fossil fuels have generated tremendous interest in the use of renewable energy sources to supply more and more of the electrical energy needs of society. The strong growth in renewable generation is expected to continue, and as its role increases, it will bring new challenges. These are principally related to the intermittency of renewable resources (Paul et al., 2008).

Increasing environmental concerns and advances in renewable energy technologies compose a favorable environment for the deployment of generators based on renewable energy sources. However, the operation of renewable energy units like wind generators presents the inconvenience of being intrinsically dependent on the variability of the wind resource (Luís, et al., 2008).

The primary energy sources for technologies like wind and solar power are not controllable and can be, at best, forecast. Energy storage used in conjunction with renewable energy has been suggested as a means to increase the use of renewable energy while maintaining a high quality of service reliability (Barton and Infield, 2004), (Schainker, 2004), (Leonhard, Grobe, 2004).

Using storage devices can help offset the effects of the inclusion of renewable energy sources

and allow them to gain a larger penetration in the electrical energy supply. Storage may also be used to transfer energy from off-periods to on-peak periods, allowing the system to operate at a more constant level and reducing energy supply costs (Paul et al., 2008).

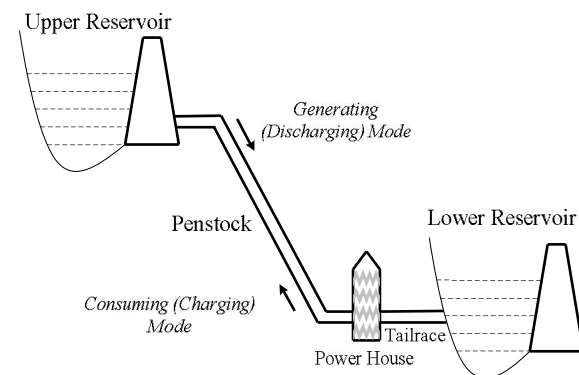


Figure.1 Simple Pump Storage Unit

A pumped-storage hydro-turbine is an energy storage device with water being recycled between an upper reservoir and a lower reservoir. Figure.1 illustrates the simple pumped-storage unit. In a vertically integrated market, hydrothermal coordination is used to reduce the fuel cost by letting the pumped-storage generators serve the peak load

and then pumping the water back into the upper reservoir at light-load periods (Wood, Wollenberg, 1996), (Conejo, et al., 1990). Under a cost-based dispatch, it is not unusual for a pumped-storage unit to be always in either the generating or the pumping mode, except for the turnaround periods (Rau and Neculescu, 1994).

In a competitive electricity market, companies having a large portfolio of generators may still use their pumped-storage units to coordinate with their thermal units to maximize the overall profit, but an individual pumped-storage unit owner will now buy and sell electricity either in the day-ahead and real-time markets or with bilateral contracts. This paper will focus on developing optimal bidding strategies for these individual pumped-storage unit owners to bid in the day-ahead market using game theory approach.

The algorithm can also be used to optimize the generation scheduling for other limited energy generation resources. Together with some price forecasting, the algorithm can be extended to evaluate the suitability of bilateral trade contracts (Ning, et al., 2004).

Pumped hydro power stations employ a long established method for storing mechanical potential energy by using surplus power for pumping water from a lower level, a reservoir or a river, to a higher level reservoir; when returning the water to the lower level, dispatchable peak- or controllable- power is generated at an efficiency of up to 80 %. Both modes of operation may be combined in a single hydraulic machine acting as a turbine or a pump. Based on the Electricity Storage Association report, worldwide close to 280 pumped hydro storage installations exist with a total power of about 90 GW or ca. 3 % of installed generating capacity, having power ratings up to several GW and storing energy for generating periods of hours to days (2010).

## 2. Power Market and Competition in Electric Energy Supply

The prosperous experiences of different industries privatization like communication, transportation and airlines in other countries caused the restructuring of energy industry. Therefore, the privatization progress has been begun. Considering the competitive and financial cases and their concentration on this continuum, each country authorizes some specific laws to face this issue. The main purpose of reconfiguration in power industry is to replace the governmental control with the private one, making competition, increasing the long-term revenue and the most important one, increasing the long-term social welfare that the law is authorized with this purpose. By reconfiguring and separating

generation, transmission and distribution departments and moving from monopoly system (vertically integrated) to competitive one, new cases arrived to planning area. In these competitive conditions, investors follow the increase of their benefits and maximizing their profits in the power market. Thus, the purpose of an investor can be summarized in gaining the maximum benefit with the least risk. One of the most significant cases of planning in power system is long-term planning, including the expansion of generation and transmission infrastructures.

The horizon of long-term planning is usually described in several years and in which planning of generation and transmission systems expansion is performed to supply the load (Barton and Infield, 2004). The possible planning objectives include: facilitating market competition; providing nondiscriminatory access to cheap generation for all customers; enhancing reliability and maintaining sufficient capacity reserves; enhancing system security, etc (Zhao and Foster, 2010).

In traditional power systems, long-term planning was coherent and the electric energy was provided by independent institution in a centralized way. In traditional systems, the efficiency is extremely low because there is no motivation for generation units with low efficiency to improve the generation units and increase the efficiency and enhance the generation technology.

In this situation, the cost function is achieved according to generation level and imposed costs. In fact, the energy generation cost function is presented in generated power level. This cost function shows that how much power is generated for its corresponding cost. Then; these costs are aggregated and divided among customers.

In restructured and competitive markets, the situation is vice-versa; means like other economic systems based on supply and demand, the scale of generator tendency for each level of generation is determined and proposed to the market. Thus, the unit with more efficiency for a specific price tends to generate more than the one with lower efficiency.

Therefore, the power market is executed like a management-economic system. In this situation, units are required to notify their readiness for energy presentation or for instance, they are required to give the minimum acceptable price for each level of generation.

In traditional power systems, load forecasting should be first performed for generation scheduling. Thus, the amount of energy demands are estimated for next 24 hours, and then the least cost generation units are introduced in an economic dispatch program. In this state the load does not have

cost elasticity and it is imposed to this case as a strict constraint. The decision making attribute for GenCos was offering their marginal price. It means that the unit selected for generation should have a generation cost equals to or less than system marginal price. The marginal price has a deep meaning in economy science that we can search these meanings in economy articles (Kirschen and Strbac, 2004). In this model, load, determines the marginal prices for each hour. In modern power systems, conditions are precisely vice-versa; it means that at first, generation companies are required to give the generation units marginal costs then the optimal generation level of each unit is determined by this cost. On the other side, the consumer's tendency for supplying their loads is received and by crossing the demand and aggregated offer, the market settlement cost is reached.

The price elasticity of electricity is too low because of its specific features and in this paper the non-elastic load is considered to simplify the analysis thus the independent system operator (ISO) denotes units which can supply load at the least cost for day-ahead power market (DA-market). In fact, in power market hourly generation level of each unit has been specified. The hourly cost is determined from proposed offers by specifying the generation units. Therefore, the most expensive accepted unit in power market determines the market price in that hour. The market clearing price (MCP) is paid to all GenCos in uniform pricing (UP) mechanism.

### 3. Pumped-Storage Unit Impacts on the Intra-day Markets

The use of the pumped storage principle to augment the run of the river, results in developing a dependable peaking resource which is greater by a factor of ten than would have been developed by the normal hydroelectric development of this same stretch of the river (Buygi, et al., 2004).

Maintenance problems would be reduced because there would be less stress induced by starting and stopping equipment. Whenever supply output was higher than load demand, the surplus would be stored in a storage facility. Whenever the load demand was higher than the supply output, the deficit would be released from the storage facility. Under such a scenario fewer plants would have to be built and the plants providing power would all be very efficient. There is only one practical storage method available, pumped storage (see Figure.2). Unfortunately, this has limited use because of geographic limitations. Nevertheless, wherever it is practical, pumped storage is very valuable. A pumped storage facility is a single mountainside hydro system in which there is limited or no inflow into the reservoir. At nighttime, when loads are low, the

generator acts as a motor and the turbine acts as a pump. Water is pumped up the mountainside back to the reservoir. During the daytime when loads are high, the water is released from the reservoir, providing hydroelectric power (Mazer, 2007).

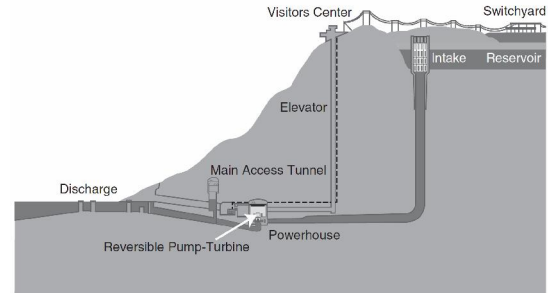


Figure 2. Pumped-Storage Plant as a Large-Scale Battery

In addition to power market and the competition in delivering the consumers energy as mentioned above, there are more markets in which the side services are tendered.

The market exists in the modern power systems is intra-day market in which the possibility of changing the primary offers from generation and distribution companies or retail companies are considered as a consumer shopping agency .

Intraday markets allow both retailers and producers to adjust their day-ahead schedules at predetermined times during delivery day. Both retailers and producers are interested in making adjustments as they update their delivery day requirements and output capabilities with information available throughout the delivery day. Retailers can sell back supply to the ISO or purchase additional supply as actual demand deviates from the day-ahead forecast. Similarly, producers may repurchase supply from the ISO or sell additional supply into the market. A market price is set by the ISO, which optimizes balancing resources that producers and retailers bid into the intraday markets.

Therefore, the market price is again determined by ISO that in this state ISO tries to optimize the generation and consumption equilibrium under intra-day markets. In such situation, pumped-storage units can be used to generate or store energy because of specific system conditions in the intra-day markets, which the hourly prices have been achieved. So the pumped-storage operator can perform its own optimal decision making with his information. Thus, this entity proceeds to buy energy in off-peaks periods in which the energy cost is low enough and functions as a load purchaser. On the other side, it means that hours in which the load demand and costs are high enough, the pumped-storage unit release its

stored energy. There are too many advantages of having such units in modern and competitive power systems. In addition; such units can change the load profile and contribute to tabulate the load profile. Suppose we sort the hourly energy demand in an ascending to descending order system. Following figure shows one kind of these curves which are known as load duration curve (LDC).

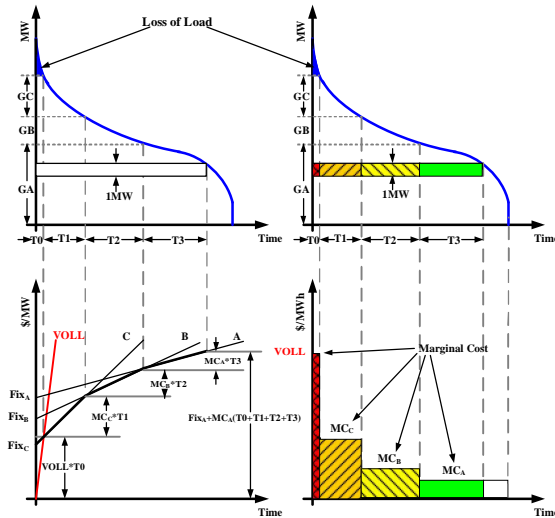


Figure 3. Cognitive model of Intermediary marketing

As it is obvious in above figures, energy price in on-peak period is appreciably high. Also, it is clear from above figures that for the base load, off-peak period, the energy price is low. Thus, a pumped-storage unit can change this curve in peak hours by purchasing energy in off-peak periods and generating energy in on-peak period. This issue from this point of view is similar to energy management persuasive policies. It leads the consumption pattern reform because of the tendency is to decrease consumption in on-peak periods and shift the unnecessary consumption to the off-peak periods (Javadi, B. Noshad, 2010).

#### 4. Game Theory Approach Implementation on Intra-day Power Market

Before introducing the game theory approach and its application to this problem, brief activities associated with power delivery from day-ahead until delivery time, will be addressed. It provides the operational to do list for setting the dispatch and managing real-time load balancing. In doing so, the section frames the issues that are addressed in subsequent sections. First we denote the short-term planning and its mathematical formulation, and then we address the intra-day market and game theory approach, which is used to improve the

simultaneous operation of thermal and pumped-storage units.

This section provides the fundamentals of short-term planning and operations within a utility environment, assuming that each utility is responsible for operating their generation units.

Since generators cannot instantly turn on and produce power, unit commitment (UC) must be planned in advance so that enough generation is always available to handle system demand with an adequate reserve margin in the event that generators or transmission lines go out or load demand increases.

Unit commitment handles the unit generation schedule in a power system for minimizing operating cost and satisfying prevailing constraints such as load demand and system reserve requirements over a set of time periods (Javadi, et al., 2009). The classic UC problem is aimed at determining the start-up and shutdown schedules of thermal units to meet forecasted demand over certain time periods (24 h to 1 week) and belongs to a class of combinatorial optimization problems (Zhu, 2009).

The objective function of vertically integrated utility system was minimizing the operation cost. This model is identified as a cost-based operation. Actually, the output of the UC program has two parts, namely defining the units in operation, which are determined by "0" and "1" (integer variables) for on and off units respectively, and determining the quantity of the generation level of operating units. Security-Constrained Unit Commitment (SCUC) provides a financially viable unit commitment (UC) that is physically feasible. The generation dispatch based on SCUC is made available to corresponding market participants (Javadi, et al., 2009).

The objective function of vertically integrated utility system was minimizing the operation cost. Therefore, this model is named cost-based operating system where the cost-based production, startup, and shutdown functions are considered in the UC formulation (Singh, 1999).

UC can provide an hourly commitment of generating units with minimum bid-based dispatch cost. The objective function (1) is composed of bid-based fuel costs for producing electric power and startup and shutdown costs of individual units for the given period. A typical set of constraints in UC includes:

- 1) Power balance;
- 2) Generating unit capacity;
- 3) System reserve requirements;
- 4) Ramping up/down limits;
- 5) Minimum up/down time limits;
- 6) Maximum number of simultaneous on/off's in a plant;



- 7) Maximum number of on/off of a unit in a given period;
- 8) Maximum energy of a unit in a given period

In monopolized and vertically integrated utility the objective was to meet the forecasted demand plus the spinning reserve to minimize the production cost, subject to each individual unit's operation constraints and system constraints.

In this part the UC problem is formulated. The objective function is shown in (1) which consists of three parameters: cost of generation, start-up and shutdown costs. The cost function was described by a quadratic or linear piecewise function. The hourly UC constraints listed below include the system power balance (2), system spinning and operating reserve requirements (3), (4), ramping up/down limits (5), (6), minimum up/down time limits (7), (8) and unit generation limits (9). Additional system-wide constraints such as fuel constraints (10) and emission limits (11) are included in this formulation for representing the market interdependencies.

$$\text{Min} \sum_{i=1}^{NG} \sum_{t=1}^{NT} [F_{ci}(P_{it}) * I_{it} + SU_{it} + SD_{it}] \quad (1)$$

ST :

$$\sum_{i=1}^{NG} P_{it} * I_{it} = P_{D,t} + P_{L,t} \quad (t = 1, \dots, NT) \quad (2)$$

$$\sum_{i=1}^{NG} R_{S,it} * I_{it} \geq R_{S,t} \quad (t = 1, \dots, NT) \quad (3)$$

$$\sum_{i=1}^{NG} R_{O,it} * I_{it} \geq R_{O,t} \quad (t = 1, \dots, NT) \quad (4)$$

$$P_{it} - P_{i(t-1)} \leq [1 - I_{it}(1 - I_{i(t-1)})]UR_i + I_{it}(1 - I_{i(t-1)})P_{i,\min} \quad (i = 1, \dots, NG)(t = 1, \dots, NT) \quad (5)$$

$$P_{i(t-1)} - P_{it} \leq [1 - I_{i(t-1)}(1 - I_{it})]DR_i + I_{i(t-1)}(1 - I_{it})P_{i,\min} \quad (i = 1, \dots, NG)(t = 1, \dots, NT) \quad (6)$$

$$[x_{i(t-1)}^{on} - T_i^{on}] * [I_{i(t-1)} - I_{it}] \geq 0 \quad (i = 1, \dots, NG)(t = 1, \dots, NT) \quad (7)$$

$$[x_{i(t-1)}^{off} - T_i^{off}] * [I_{it} - I_{i(t-1)}] \geq 0 \quad (i = 1, \dots, NG)(t = 1, \dots, NT) \quad (8)$$

$$P_{i,\min} \leq R_{it} + P_{it} \leq P_{i,\max} \quad i = 1, 2, \dots, NG \quad t = 1, 2, \dots, T \quad (9)$$

$$\sum_{t=1}^{NT} \sum_{i \in FT} [F_{fi}(P_{it}) * I_{it} + SU_{f,it} + SD_{f,it}] \leq F_{FT}^{\max} \quad (10)$$

$$\sum_{t=1}^{NT} \sum_{i=1}^{NG} [F_{ei}(P_{it}) * I_{it} + SU_{e,it} + SD_{e,it}] \leq E_S^{\max} \quad (11)$$

Broadly speaking, decision theory is a mean of analyzing in which a series of options should be taken when it is uncertain exactly what the result of taking the option will be (Raiffa, 1968). Decision theory concentrates on identifying the “best” decision option, where the notion of “best” is allowed to have a number of different meanings, of which the most common is that which maximizes the expected utility of the decision maker. Decision theory provides a powerful tool by which to analyze scenarios in which an agent must make decisions in an unpredictable environment.

Game theory is a close relative of decision theory, which studies interactions between self-interested agents (Binmore, 1992). In particular, it studies the problems of how interaction strategies can be designed that will maximize the welfare of an agent in a multi-agent encounter, and how protocols or mechanisms can be designed that have certain desirable properties. Notice that decision theory can be considered to be the study of games against nature, where nature is an opponent that does not seek to gain the best payout, but rather acts randomly. Given this brief description, it comes as no surprise to learn that many of the applications of game theory in agent systems have been to analyze multi-agent interactions, particularly those involving negotiation and co-ordination (Parsons and Wooldridge, 2000).

Cournot model of oligopoly competition is one of the prevalent models, was introduced by Augustin Cournot (Cournot, 1897).

In the Cournot model of duopoly, two firms produce a homogenous product and must decide how much to produce without knowing the decision of the other. There are several similarities between the Cournot model and the energy generation in intra-day market. This makes the Cournot model applicable to the competitive electricity market.

After formulating the short-term operation behaviors for players, the key task is to find Cournot equilibrium. In the Cournot duopoly model, the Cournot equilibrium is a quantity pair that maximizes the profit of each firm, given other firm's output quantity (Cournot, 1897). In terms of mathematics, the optimal quantity pair  $(q_1^*, q_2^*)$  is the Cournot equilibrium if, for firm 1,  $q_1^*$  solves:

$$\text{Max}_{q_1} \pi_1 = (q_1, q_2^*) \quad (12)$$

Where:

$\pi_i$ : Profit for firm “i”;  $i=1,2$ ;

$q_i$ : Quantities produced by firm “i”;

$q_i^*$ : Optimal quantities produced by firm “i”;

The profit function for firm 1 can be represented by (13)

$$\pi_1 = (q_1, q_2) = p(q_1 + q_2)q_1 - c_1(q_1) \quad (13)$$

Where:

$p(\cdot)$ : Market price for aggregate quantity.

$c_i(\cdot)$ : Cost function for firm “i”.

After executing the UC program, the units generation amount and the start-up and shutdown time interval of each unit is determined. Also, the energy market hourly prices are determined by executing this program. Now, it is time to execute the intra-day market. In this state, the generation companies, independent power producers, retailers, purchase agencies and distribution companies proceed to perform essential reforms to get more benefit considering the more accurate load forecasts and their hourly prices. This opportunity from the pumped-storage unit operator point of view is individual and valuable considering its unit technical constraints (Javadi, Monsef, 2009).

The objective function (14) represents the revenues of pumped-storage plant including the trading in energy and regulation markets.

$$\text{Max} \sum_{t=1}^T [P_g(t) - P_p(t)] * \lambda(t) \quad (14)$$

The above objective function represents that the market price has a vital role in maximizing the profit of selling energy or in purchasing the energy from limited energy units in intra-day market.  $\lambda(t)$  is the energy market clearing price at time “i”,  $P_p(t)$  and  $P_g(t)$  are the pumping power to the reservoir and generating energy from the reservoir, respectively. The constraints are as follow:

$$U_g(t) * P_{\min} \leq P_g(t) \leq U_g(t) * P_{\max} \quad (15)$$

$$U_p(t) * P_{\min} \leq P_p(t) \leq U_p(t) * P_{\max} \quad (16)$$

$$U_g(t) + U_p(t) \leq 1 \quad (17)$$

$$U_g(t-1) + U_p(t) \leq 1 \quad (18)$$

$$U_p(t-1) + U_g(t) \leq 1 \quad (19)$$

$$E(t) = E(t-1) - P_g(t) + \eta P_p(t) \quad (20)$$

$$E_{\min} \leq E(t) \leq E_{\max} \quad (21)$$

$$E_{\text{end}} \geq \beta E_0 \quad (22)$$

Equations (15) and (16) show the lower and upper limits of the generating, pumping powers respectively. To eliminate conflict between different modes in a specific hour, equation (17) is considered. Equations (18) and (19) are applied to satisfy the changeover times. The changeover time of a pumped-storage plant is typically between 15 to 30 minutes. For a DA market operated on an hourly basis, this constraint translates to a plant having a buffer of at least one hour at zero generation between generating and pumping modes (Lu, et al., 2004). Equations (20) to (22) are related to the amount of energy stored in the upper reservoir. The amount of energy stored in the upper reservoir in each hour is calculated by (20). The ratio of the transformation rates of water into energy during pumping and generating modes is called round-trip efficiency ( $\eta$ ). The lower and upper limits of energy stored amount in the upper reservoir are presented by (21). In addition, in order to reserve enough energy to be stored for the subsequent week, equation (22) is applied. The parameter  $\beta$  adjusts the amount of energy that should be stored for the subsequent week. If lower prices for the next week are forecasted, the pumped storage plant owner will choose a low value for  $\beta$ . This parameter can be varied while energy stored constraints are satisfied. The optimization problem of equations (14) to (22) is a mixed integer programming (MIP) problem.

Note that the efficiency of such unit is about 70% to 90% that 80% percent is considered in this paper. ( $\eta=0.8$ )

As mentioned above, purchasing energy from market causes the system load to increase and on the other hand, selling energy to the market causes the hourly price to decrease. These subjects are in contrast with each other and the pumped-storage unit operator's strategy alters according to its own function to participating in the power market. Thus, this issue is such a one based on non-cooperative game theory and it is not a simple optimization issue anymore. The best model for executing and evaluating this is Cournot duopoly model in which one side is pumped-storage unit's operator decision making and the other side is intra-day market with all participants. In Cournot duopoly model, two institutions are generating the homogenous product and they choose their own optimal strategy without any knowledge about other sides. In this model, there are too many similarities to such a model that it can

be used to perform the best strategy determination program in the intra-day market.

The first step in operation of the intra-day market for the pumped-storage unit's operator decides whether the under control unit wants to sell the generation capacity or wants to purchase the energy from the market. On the other side, there is energy market and other competitors in which disregarding to the proposed offers and amount of loads, hourly prices and generation amount and the capacity of each accepted entity are determined. Thus, the decision variable for each participant is the strategy of purchasing energy or selling capacity. In the energy market, the production of each unit is the same.

After formulating the rivals attribute in the energy and intra-day market, the purpose is to find the optimal point in Cournot equilibrium. In Cournot duopoly model, the optimal point regards to Cournot equilibrium is the state in which for that regular pair, it maximizes the both side's benefits from purchasing or selling the capacity.

Table1. Unit operational constraint

Unit	Unit Constraints								
	Pmax	Pmin	Ramp Up	Ramp Down	CSt	CSh	Init	MUT	MDT
1	500	150	100	100	4500	600	8	5	5
2	500	150	250	100	5000	620	8	5	5
3	130	20	35	40	550	670	-5	2	2
4	130	20	35	40	560	700	4	2	2
5	162	25	40	40	900	1100	-6	3	2
6	80	20	15	20	170	370	3	2	2
7	85	25	20	20	260	300	3	2	2
8	55	10	10	10	40	40	-1	0	1
9	55	10	10	10	30	40	-1	0	1
10	55	10	10	10	35	40	-1	0	1

## 5. Case Study and Simulation

To evaluate the proposed algorithm in the energy market, recommended network has been considered (Javadi, Monsef, 2009). This test system consists of 10 generation buses that participate in energy market.

Each bus includes several generators that each one offers their cost to the market. Table 1 shows the generation units operating constraints. In this paper it is assumed that the market is executed in perfect single-side market and only generation units offer price, it means that demands have a price elasticity of zero and considered as a solely constraint. Also, it is supposed that there is only one pumped-storage unit in the system and it only participate in intraday market. This unit capacity is 100 MW and its daily release energy constraint is 1000 MWh. The generation hourly limit to switch mode is considered about an hour. At the first hour of this study, energy production capability considered as 400 MWh. Figures 4 and 5 show the mentioned unit effect on the daily load profile and load duration curve, respectively. In Figure 4, the continuous curve is daily load in the day-ahead market and the dotted line curve shows a state in which a pumped-storage unit participates in the intra-day market.

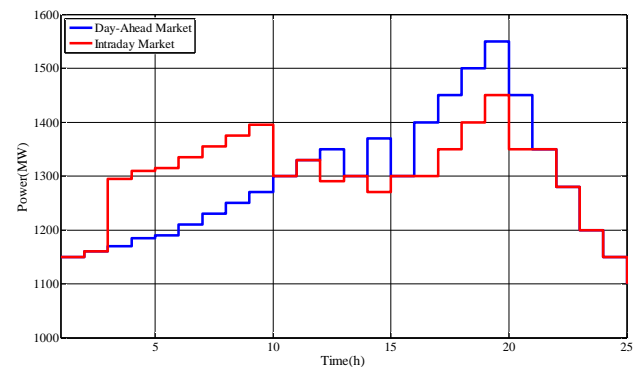


Figure. 4 Load curve in day-ahead market (continuous curve) and intra-day market (dotted line curve)

## 6. Discussion and Conclusion

In this paper the generation unit participation in energy day-ahead and intra-day market has been analyzed and evaluated according to the game theory approach. As mentioned before, one of the limited energy units is pumped-storage unit, which uses the water energy in the best conditions in addition to an appropriate water resource management. The pumped-storage unit has more advantages than the cascaded hydroelectric units which are installed on a dam. And the specified amount of water can be used for a long-time to generate energy and each time it is necessary, the penstock can be opened for other intentions such as drinking water or agriculture utilizations.

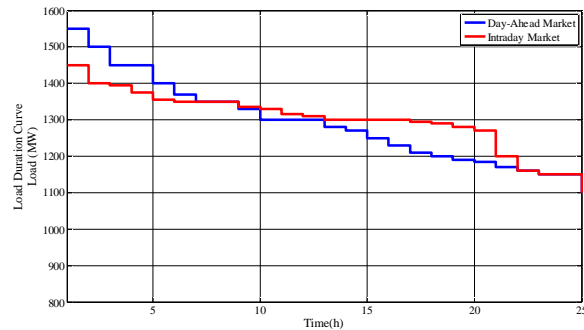


Figure. 5 Load duration curve in executing two markets with and without the pumped-storage unit attendance

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## Effect of cobalt, and nitrogen forms on nitrate accumulation in Jew's mallow plant as affected by a nitrification inhibitor

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**Abstract:** A pot experiment was established in the green house of National Research Centre to evaluate the effect addition of cobalt element at a rate 10 ppm, different rates of nitrogen (100 and 200) ppm N and forms of nitrogen as a Sodium Nitrate  $\text{NaNO}_3$ , Ammonium Sulphate  $(\text{NH}_4)_2\text{SO}_4$  and Urea  $(\text{NH}_2)_2\text{CO}$  as others two treatments with and / or without a nitrification inhibitor (N-serve) on mineral composition and nitrate accumulation in Jew's mallow plant in alluvial soil of type clay loam. The results revealed that a positive contact was found between nitrogen rates and each of fresh, dry weight and plant contents of Cobalt, Nitrogen, Phosphorus, Potassium, Nitrate and residual effect of inorganic Nitrogen. While, a negative relation with trace elements contents (Fe, Mn, Zn and Cu) was observed. Treatments of ( Ammonium sulphate and Urea) with Cobalt and (N-serve) as a nitrification inhibitor registered the highest value of all the determinations studied, except a nitrate accumulation in plant which recorded the highest values with (Sodium Nitrate, Ammonium Sulphate and Urea ) with cobalt and without inhibitor respectively. Residual effect of inorganic nitrogen registered the highest values with (ammonium sulphate and urea) treatments with cobalt and (N-serve) inhibitor respectively. Results concluded that.

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**Keywords:** Nitrogen – Cobalt – (N-serve) inhibitor – Nitrate accumulation – Jew's mallow-clayloam soil.

### 1. Introduction

People are continuously exposed to nitrate and nitrite through drugs, water and food, fresh vegetables are often rich source of nitrate and nitrite intake. Egyptians consume great quantities of nitrate in Egyptian vegetables all over the year. Tests of nitrate accumulation in Egyptian vegetables showed considerable high values as compared to those found in vegetables grown in several European countries (Hanafy *et al.*, 1991) and (Blom-Zandstra, 1989) in spite of the high intensity and long duration of light in Egypt which favour nitrate reduction in plants. This could be mainly due to intensive application of nitrogen fertilizers alone by Egyptian farmers which results in imbalanced nutritional status of the plants and consequently high nitrate accumulation. Source of nitrogen effect on nitrate accumulation of nitrate contents of lettuce can also be reduced by the partial replacement of nitrate with ammonium in the nutrient solution culture (NFT) (Van der Boon *et al.*, 1990). In soil grown crops, however, applied ammonium is relatively quickly converted to nitrate at moderate or high soil temperatures. The application of a nitrification inhibitor can however, effectively suppress the oxidation of ammonium by Nitrosomonas bacteria (Amberger, 1979) and can therefore increase the effectiveness of ammonium

application in reducing of nitrate content of lettuce (Roorda VanEy singa, 1984).

Nitrate levels can go up and down rapidly in plants. It accumulates only in the vegetative parts of plants, not in the grain or fruit. Lately some studies indicated that cobalt element has a beneficial effect at nitrogen assimilation and transformations in plants; this may be caused by accumulation of nitrate, and using little of nitrogen fertilizers. (Youssef *et al.*, 2001 and Youssef, 1997) revealed that Cobalt remarkably increased fresh and dry weight where it glorified the advantage of nitrogen fertilizer in tomato plants. (Abd Elafatha, 2008) showed that a positive effect with rates of cobalt and nitrogen uptake were found that reflected on dry matter weight of plants. Seemed that cobalt element encourages plant uptake for nutrients which reflect on the dry matter production in lettuce plants.

The objective of the present study was to examine the effect of nitrogen form and application of cobalt with nitrogen on yield and nitrate content of grown Jew's mallow plant. The necessity of a nitrification inhibitor when nitrogen is continually applied in ammonium form was also examined.

### 2. Materials and Methods

A green house experiment was conducted at National Research Centre, during of May to July

2008 to evaluate different rates and forms of nitrogen fertilizers effect with cobalt addition on mineral composition and nitrate accumulation in Jew's mallow plant (*Corchorus olitorius*. L.) C.V. Balady. Experimental soil was alluvial of type clay loam texture from Giza governorate at south Egypt, Table (1) indicated that some chemical and physical characteristics of the experimental soil.

The experiment include three factors were, different forms of nitrogen as  $\text{NaNO}_3$ ,  $(\text{NH}_4)_2 \text{SO}_4$  and  $(\text{NH}_2)_2\text{CO}$  (100 and 200) ppm N. Cobalt element at a rate 10 ppm, a nitrification inhibitor namely (N-serve) applied as a chemical compound, 2-chloro-6 (trichloro methyl pyridine) added at a rate 1% of N-fertilization. (N-serve) was introduced in combination with ammonium sulphate and urea and / or without. Nitrogen fertilization was added after 10 days of emergence.

Pot filled with ten kg soil were used and 300 ppm of dihydrogen potassium phosphate  $\text{KH}_2 \text{PO}_4$  / pot as a source of P and K at before sowing was added. A control treatment receiving no addition was established. The experiment was laid out in randomized complete block design with three replicates. All pots were irrigated in a way to maintain soil moisture level at 80% of the water holding capacity during the growing season. Plant samples of experiment were collected after 40 days of sowing, fresh and dry weights of leaves and stems were recorded and dried in an oven at  $70^\circ\text{C}$  ground and prepared for analysis. Nitrate was determined in fresh plant leaves nitrate was extracted with warm water and shaking for two hours, it was determined by using devarda alloy according to (Cottenie *et al.*, 1982).

**Table 1: Some chemical and physical characteristics of the experimental soil.**

Parameters	Value	Parameters	Value
Soil pH (1:2.5)	7.48	Water holding capacity %	42.00
Ec $\text{dsm}^{-1}$ (1:5)	0.47	Organic matter %	0.502
$\text{NH}_4$ ppm	3.0	Total $\text{CaCO}_3$ %	1.25
$\text{NO}_3$ ppm	9.3	Mechanical composition %	
Total nitrogen %	0.012	Coarse sand	9.23
Available P ppm	31.0	Fine Sand	25.6
Available K ppm	64.0	Silt	22.6
Available Fe ppm	10.0	Clay	42.6
Available Mn ppm	17.0	Texture type clay loam	
Available Zn ppm	7.23		
Available Co ppm	2.33		
Available Cu ppm	1.67		

Total nitrogen was determined by using microkjeldahl technique according to (Jackson, 1967). Phosphorus was determined by colorimetrically according to (Cottenie *et al.*, 1982). Potassium was determined by using flam photometer according to (Cottenie *et al.*, 1982). Fe, Mn, Zn, Cu and Cobalt were determined using the Atomic absorption as according to (Jackson, 1967).

Standard analysis of variance procedure of the completely randomized design was applied on data and the means were compared using duncan's multiple rang test and determined the L.S.D. test at 0.05 and 0.01 according to (Steel and Torrie, 1980).

### 3. Results and Discussion

#### \* Fresh matter Status:

Fresh weight to Jew's mallow plant show that Cobalt, different rates and forms of nitrogen (100 and 200) ppm N under a nitrification inhibitor using in alluvial soil of type clay loam and effect of harvesting time.

From data in table (2) noticed that 200 ppm N treatments were high fresh weight than it with 100 ppm N and that without cobalt.  $(\text{NH}_4)_2 \text{SO}_4$  + NS at a rate 100 ppm N without cobalt treatment increased than other treatments also afternoon weights were increased than morning weights.

The same results were found with cobalt treatments with a rate of 100 ppm N except  $\text{NaNO}_3$  treatment as recorded of head value in the afternoon time. All the differences between treatments were significantly under each two levels. On the other beside that 200 ppm N treatments without Cobalt showed that urea +NS treatment registered of highlight comparative with other treatments that's without cobalt and afternoon time, while  $(\text{NH}_4)_2\text{SO}_4$ +NS with cobalt and a afternoon time as registered highest value comparative with other treatments Urea+NS treatment at section of 200 ppm N as cobalt and morning time recorded highest value comparative with other treatments and increasing in comparative with control respectively.

All differences between treatments were significantly under each of two levels. From previous results concluded that a nitrification inhibitor caused of increasing at fresh weight whereas all treatments which increased at fresh weight were with the inhibitor, cobalt and 200 ppm N where Urea+NS with

200ppm N and cobalt in the morning and  $(\text{NH}_4)_2\text{SO}_4$ +NS with cobalt with section of 200 ppm N in the afternoon may be data stoppage of light assimilation process through the night and tend the plant to storing of nourture matter and the growing plant tissues. Efficiency of the inhibitor stoppage of Nitrozomonas bacteria activity which convert of the ammonium to Nitrite then to nitrate which it was lost by the leaching during of soil irrigation and volatilization and denitrification processes also that nitrate carry of negative charge where was not kept on adsorption complex while the ammonium on was kept on (Abd El-Fattah, 1988) shown that fresh matter yield of the wheat plant was higher when fertilized with  $(\text{NH}_4)_2\text{SO}_4$ -N and Urea than  $\text{NO}_3$ -N. The nitrogen uptake by wheat plants was significantly higher for the  $[(\text{NH}_4)_2\text{SO}_4+\text{urea}] + \text{N-serve}$  than for the other treatments. (Nadia, 2006) applying cobalt in a suitable concentration for each crop gave a significant increase in the fresh and dry matter compared the control, she noticed that.

**Table 2: Fresh weight (gm/pot) to Jew's mallow plant as affected by cobalt. Nitrogen forms and a nitrification inhibitor (N-serve).**

Treatments	100 ppm N			
	Without Cobalt		With Cobalt	
	Morning	Afternoon	Morning	Afternoon
Control	12.0	11.2	13.0	11.5
$\text{NaNO}_3$	16.0	25.5	17.4	27.5
$(\text{NH}_4)_2\text{SO}_4$	18.0	22.0	20.5	24.00
$(\text{NH}_4)_2\text{SO}_4$ +NS	24.5	24.7	25.6	27.0
Urea	15.6	24.0	23.0	25.6
Urea+NS	16.0	26.0	25.0	27.0
L.S.D 0.05	2.05	2.18	2.12	2.13
L.S.D. 0.01	2.90	3.05	2.97	2.98
200 ppm N				
$\text{NaNO}_3$	17.5	18.0	28.0	21.0
$(\text{NH}_4)_2\text{SO}_4$	22.6	25.7	23.0	28.0
$(\text{NH}_4)_2\text{SO}_4$ +NS	28.8	29.7	28.0	32.0
Uea	18.0	26.0	27.0	28.0
Urea+NS	21.0	31.0	32.0	30.6
L.S.D. 0.05	2.08	2.17	2.18	2.17
L.S.D. 0.01	2.94	3.01	3.05	3.25

**\* Dry Matter Status:**

Data in table (3) showed that dry weight to Jew's mallow plant as affected by cobalt addition 10 ppm and different rates of nitrogen N and forms with or without a nitrification inhibitor and harvesting

time where were noticed at a section (100 ppm N) head values was recorded with  $\text{NaNO}_3$ ,  $(\text{NH}_2)_2\text{CO}$  and  $(\text{NH}_4)_2\text{SO}_4$  treatments with cobalt without inhibitor and afternoon time respectively following it, (Urea+NS), urea and  $(\text{NH}_4)_2\text{SO}_4$ +NS with cobalt and

morning and afternoon times respectively where were increasing rates in comparison with control as following (124, 121, 106, 94, 91 and 74)% respectively the greatest rate 124 % to sodium nitrate with cobalt in the afternoon time treatment. On the other beside at a section 200 ppm N treatments, head values were of urea +NS treatment with cobalt at morning time then  $(\text{NH}_4)_2\text{SO}_4$ +NS treatment with cobalt at afternoon time, then Urea with cobalt without inhibitor at the morning time. The increasing rates in comparative with control as (62, 46 and 44)% respectively. The second order was found  $(\text{NH}_4)_2\text{SO}_4$ +NS with cobalt at the morning time then the same previous treatment but without cobalt at the afternoon time. The increasing rates in comparison control as (42, 63 and 63 ) % respectively.

From previous results show that cobalt and nitrogen is necessary to structure of dry matter for plant. (Richard and Byrd 1991 and Jan Zen *et al.*, 1996) studied the effect of urea applied with and without (N-serve) on grown in silty loam soil. They recommended that N application and N plus (N-serve) addition enhanced the plant growth and produced the highest yield.

(Youssef *et al.*, 2001 and Youssef, 1997) revealed that cobalt remarkably increased fresh and dry weight of shoots and roots. The amounts of dry matter (shoots and roots) of tomato plants were the highest when Co was spotted in 1mm compartment compared with that of other soil compartments.

#### \* Cobalt Contents Status:

Data in table (4) contents indicated that cobalt in Jew's mallow (ppm) as affected by cobalt addition and different rates, forms of nitrogen under effect a nitrification inhibitors nitrapyrin (N-serve). Treatments of nitrogen at a rate (100 ppm) Clear that head values was of  $(\text{NH}_4)_2\text{SO}_4$  without cobalt at the afternoon time treatment then the same treatment but with cobalt and at the morning time.

Following it was of Urea+Co without inhibitor at the morning time treatment. Increasing rates in comparison control (207,124 and 61) % respectively, highest value was of  $(\text{NH}_4)_2\text{SO}_4$  without cobalt and without inhibitor. All the differences between treatments were significant under each of two levels except little of values. Nitrogen treatments at a rate (200 ppm) reveal that, head values was of  $(\text{NH}_4)_2\text{SO}_4$ +NS without cobalt at the afternoon time, then  $(\text{NH}_4)_2\text{SO}_4$  treatment without cobalt and inhibitor at the afternoon time treatment following it the same previous treatment but with cobalt at the morning time then the same treatment but at the afternoon time.

Increasing rates in comparison with control as (58,45,221 and 66)% respectively. Increasing highest rate was of  $(\text{NH}_4)_2\text{SO}_4$  treatment with cobalt without inhibitor at the afternoon time. All the differences between treatments were significant under effect each of two levels.

From previous results conclusion that most of high values were registered of cobalt contents to Jew's mallow plants to treatments without inhibitor and without cobalt except  $(\text{NH}_4)_2\text{SO}_4$ +NS at a rate 200 ppm N, and without cobalt at the afternoon time as it recorded highest value of where cobalt contents also most of high values were recorded without inhibitor treatments, seem that the inhibitor inhabitation to cobalt uptake but nitrogen encourage it. As increase cobalt uptake with increasing nitrogen was added. On the other hand indeed most of middle values was recorded with the inhibitor. Also most of high value at the afternoon time, therefore cobalt uptake associated with abundant nitrogen absorption regardless about the inhibitor (Mathers *et al.*, 2004) stated that nitrapyrine treatment decreased Co uptake. On the others hand, (Warren *et al.*, 1998) detected that nitrogen encourage cobalt uptake or other cations in their studies on corn and winter wheat forage.

Data in table (5) show some macronutrients as a percentage contents (N, P and K) in Jew's mallow plants as affected by cobalt addition , different rates of nitrogen and forms under effect a nitrification inhibitor application.

#### \* Nitrogen contents Status:

Rate of nitrogen at (100 ppm) show that head value was of  $\text{NaNO}_3$  without cobalt and without inhibitor at afternoon time treatment then  $(\text{NH}_4)_2\text{SO}_4$ +NS] with cobalt and with inhibitor treatment following it  $(\text{NH}_4)_2\text{SO}_4$  without cobalt, without inhibitor at the morning time treatment. Increasing rates as a percentage in comparison control (39, 36 and 21.5) respectively, highest rate was of  $\text{NaNO}_3$  treatment without cobalt, without inhibitor at the afternoon time, may be mean of reason  $\text{NO}_3^-$  ion is at soil solution solubility easy and available to plant uptake whereas was not kept on the soil surface particles. At the second part of table (5) as a rate of nitrogen 200 ppm was added. A Head value was of also  $\text{NaNO}_3$  with cobalt and without inhibitor at afternoon time treatment. Following it (Urea) treatment without cobalt, without inhibitor at the afternoon time treatment then (Urea+NS) without cobalt, with inhibitor at afternoon time, increasing rates as a percentage in respectively (43.9 , 32.5 and 29). This may be due to  $\text{NO}_3^-$  ion is easy and available uptake than other forms of nitrogen.

**Table 3: Dry weight (gm/Pot) to Jew's mallow plant as affected by Cobalt, nitrogen forms, a nitrification inhibitor (N-serve) and harvesting time.**

Treatments	100 ppmN			
	Without Cobalt		With Cobalt	
	Morning	Afternoon	Morning	Afternoon
Control	3.4	3.3	3.4	3.4
NaNO <sub>3</sub>	3.9	4.4	5.2	7.6
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	4.2	3.8	5.6	7.0
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> +NS	5.4	4.6	5.8	5.9
Urea	3.9	4.3	6.5	7.5
Urea+NS	3.8	4.8	6.6	6.5
L.S.D 0.05	1.45	1.48	1.53	1.51
L.S.D. 0.01	2.08	1.93	1.99	1.97
200 ppm N				
NaNO <sub>3</sub>	3.8	3.8	4.5	4.6
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	4.9	5.9	5.8	5.9
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> +NS	6.2	6.2	6.4	6.7
Urea	4.3	5.4	6.5	5.9
Urea+NS	4.6	6.5	7.3	6.5
L.S.D. 0.05	1.49	1.47	1.55	1.57
L.S.D. 0.01	1.59	1.94	1.98	2.07

**\* Phosphours contents:**

Rate of nitrogen (100 ppm) at the first part of table (5) indicated that head values was of (Urea +NS) treatment as with cobalt at afternoon time following it (Urea) treatment with cobalt, without inhibitor at afternoon time treatment and [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>+NS] treatment with cobalt, with inhibitor at afternoon recorded the same previous value. The following value common between the most treatments, it is 0.45% phosphorus contents increasing rates as the previous order in comparison control (100,66,66 and 50)%.

At the second part of table (5) as (200 ppm N) indicated to head values was of (Urea+NS) treatment as with cobalt, with inhibitor at afternoon time, following it (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>+NS and (Urea+NS) as with cobalt, only the latter with inhibitor treatments as it's the same values then (Urea) with cobalt, without inhibitor, (Urea without cobalt and inhibitor) and (Urea +NS) without cobalt, with inhibitor at afternoon time. In creasing rates at the previous order (30, 20, 20, 66 and 66) % respectively, highest rates were to only Urea at afternoon time and (Urea +NS) treatments without cobalt, that's mean it the inhibitor and cobalt were incourage phosphours absorption.

All the differences between treatments were significant under each of two levels except some little values.

**\* Potassium contents status:**

Data at the first section of table (5) as (100 ppm N) indicated to a head value was of (NaNO<sub>3</sub>) treatment without cobalt, following it each of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>+NS) treatment without cobalt with inhibitor at the morning time and [(NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>] treatment with cobalt, without inhibitor at the morning time as its recorded the same values. Then (NaNO<sub>3</sub>) treatment with cobalt at the morning time. Increasing rates as a percentage in comparison control at the same treatments previous order as (24, 22, 22 and 18)% respectively.

Highest increasing rate was of (NaNO<sub>3</sub>) treatment, without cobalt, without inhibitor. All the differences between treatments were significant under each of two levels except some little values. Data in the second section of table (5) as (200 ppm N) indicated to head values were of (Urea +NS) treatment as without cobalt, with inhibitor at morning time and [(NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>+NS] treatment as with cobalt, with inhibitor at the morning time where it's the same



value, following it  $(\text{NH}_4)_2\text{SO}_4$  and (Urea) treatments as with cobalt, without inhibitor at the morning time as it's the same value, then  $(\text{NaNO}_3)$  treatment as without cobalt without inhibitor at afternoon time, increasing rates as a percentage in comparison control as the same treatments previous order (33,20,10,10 and 42.5) respectively, highest value of increasing rate was of  $(\text{NaNO}_3)$  treatment as without cobalt at afternoon time. All the differences between treatments were significant under each of two levels except some little values.

Previous results indicated efficiency of the inhibitor as keep on nitrogen at form  $\text{NH}_4^+$  and increase of  $\text{NH}_4/\text{NO}_3$  ratio. This cause increasing of absorption of N, P and K. (Sullivan and Hovlin 2005)

found that inhibit (N-serve) treatments whereas the effect of inhibition was stronger than one other whereas found that  $\text{NH}_4/\text{NO}_3$  ratio is higher than one other and this difference continued until the experiment end. In the treatment Urea with inhibitor was  $\text{NH}_4/\text{NO}_3$  ratio high as a result effect of N-serve alone. (Shehata Nadia *et al*, 2008) revealed that the addition of 10 ppm of cobalt had a significant primitive effect on nitrogen, phosphorus and potassium content in fruits, as compared with that of control and another cobalt levels increasing cobalt concentration up to 30.0 ppm, resulted in proportion significant reduction.

**Table 4: Cobalt contents (ppm) in Jew's mallow plant as affected by addition of cobalt, nitrogen forms, a nitrification inhibitor (N-serve) and harvesting time.**

Treatments	100 ppm N			
	Without Cobalt		With Cobalt	
	Morning	Afternoon	Morning	Afternoon
Control	68.0	74.0	98.0	79.0
$\text{NaNO}_3$	100	119	123	118
$(\text{NH}_4)_2\text{SO}_4$	124	227	220	118
$(\text{NH}_4)_2\text{SO}_4+\text{NS}$	129	101	113	108
Urea	107	103	158	101
Urea+NS	133	103	117	166
L.S.D 0.05	8.55	9.15	11.9	9.44
L.S.D. 0.01	12.0	12.3	16.3	12.8
200 ppmN				
$\text{NaNO}_3$	174	182	178	117
$(\text{NH}_4)_2\text{SO}_4$	178	263	221	194
$(\text{NH}_4)_2\text{SO}_4+\text{NS}$	181	287	120	122
Urea	132	187	164	110
Urea+NS	162	202	140	95
L.S.D. 0.05	9.07	12.6	9.82	8.62
L.S.D. 0.01	12.4	17.6	13.5	11.8

**Table 5 : Some macronutrients contents (%) in Jew's mallow plant as affected by cobalt, and nitrogen forms, rates and a nitrification inhibitor (N-serve) and harvesting time.**

Treatments	100 PPm N											
	Without cobalt						With cobalt					
	Morning			Afternoon			Morning			Afternoon		
	N	P	K	N	P	K	N	P	K	N	P	K
Control	3.30	0.30	4.51	3.81	0.30	3.65	3.31	0.22	4.50	3.82	0.31	3.51
NaNO <sub>3</sub>	3.92	0.45	5.63	5.32	0.30	4.53	3.73	0.23	5.31	4.03	0.40	4.30
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	4.01	0.22	4.33	3.21	0.30	3.95	3.43	0.32	5.55	3.85	0.45	5.01
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> +NS	3.95	0.31	5.54	3.70	0.45	3.93	4.54	0.35	5.06	4.02	0.53	4.53
Urea	3.75	0.32	4.07	3.92	0.45	4.62	3.56	0.30	5.08	3.57	0.55	4.56
Urea+NS	3.63	0.33	5.09	3.73	0.45	4.60	3.67	0.32	5.05	3.92	0.62	4.05
L.S.D 0.05	0.09	0.03	0.09	0.08	0.03	0.06	0.09	0.07	0.14	0.12	0.03	0.09
L.S.D. 0.01	0.12	0.04	0.12	0.11	0.04	0.08	0.12	0.09	0.19	0.17	0.04	0.12
200 pp m N												
NaNO <sub>3</sub>	3.91	0.33	4.51	4.05	0.35	5.21	4.02	0.21	5.00	5.50	0.51	3.85
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	4.33	0.35	4.51	4.32	0.45	4.41	4.25	0.30	5.52	4.31	0.67	5.02
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> +NS	4.20	0.31	5.08	4.13	0.43	4.71	4.11	0.42	6.08	3.98	0.66	4.11
Urea	4.31	0.30	5.08	5.05	0.54	5.10	3.71	0.45	5.53	4.13	0.53	4.81
Urea+NS	4.21	0.32	6.03	4.91	0.57	5.03	3.93	0.35	5.04	4.85	0.65	4.83
L.S.D. 0.05	0.11	0.010	0.14	0.08	0.02	0.09	0.012	0.006	0.12	0.08	0.06	0.13
L.S.D. 0.01	0.15	0.013	0.19	0.11	0.03	0.12	0.016	0.008	0.17	0.11	0.08	0.19

NS: as a nitrification inhibitor nitrapyrin (N-serve) at a rate 1% of nitrogen rates were added.

#### \* Nitrate contents status:

Data in Table (6) indicated that the nitrate contents in Jew's mallow as affected by cobalt and different rates, forms of nitrogen (100, 200)ppm under effect a nitrification inhibitor, nitrapyrin (N-serve) application . At the first section of results where (100 ppm N ) indicated, head values was of (NaNO<sub>3</sub>) treatment as with cobalt at morning time, following it was of (Urea) treatment, with cobalt, without inhibitor at morning time, then (NaNO<sub>3</sub>) treatment without cobalt without inhibitor at morning time. Increasing rates as a percentage in comparison control at the same treatments previous order (157, 153 and 145) respectively. At the second section of table as (200 ppm N) head values was of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>) treatment with cobalt, without inhibitor at morning time, following it (NaNO<sub>3</sub>) treatment, with cobalt without inhibitor at afternoon time, then (Urea) treatment, with cobalt at morning time respectively. Increasing rates as a percentage at the same previous order in comparison control (229, 116 and 214) receptively.

At inclusive look on the previous results noticed that most of the treatments which it registered

of high values of nitrate contents in Jew's mallow plants it not contain of inhibitor nitrapyrin (N-Serve) but it contain cobalt element and at the morning time.

This indicated that the inhibitor inhibit of nitrate formation in soil from ammonium and urea fertilizers transformations and also that this treatments were with cobalt was added at a rate (10 ppm) in soil, this means it cobalt may retard of nitrate transformations to protein formation in plants also that most this treatments at morning time, may to reason stoppage of assimilation light during the night of what cause a nitrate accumulation during at night.

Also was found a positive contact between nitrogen rates were added and rate of nitrate in plants. (Maynard *et al*, 2006 and Mubashir, 2010) the concentration of nitrate in plant tissues is always in a dynamic state since it represents the difference between rates of absorption and rates of assimilation within the plant. For a particular plant part, translocation of absorbed nitrate to or form the part is also involved. (Yoon and Choi, 1999) found that accumulation of nitrate -N in the morning was greater than in the afternoon in the Jew's Mallow plant.

**Table 6: Nitrate contents (ppm) in fresh leaves to Jew's mallow plant as affected by cobalt, nitrogen forms, nitrification inhibitor (N-Serve) and harvesting time.**

Treatments	100 ppm N			
	Without Cobalt		With Cobalt	
	Morning	Afternoon	Morning	Afternoon
Control	147	126	147	221
NaNO <sub>3</sub>	360	231	378	342
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	336	281	284	243
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> +NS	212	226	318	204
Urea	259	245	372	255
Urea+NS	240	221	314	229
L.S.D 0.05	15.9	15.2	18.9	16.7
L.S.D. 0.01	21.8	20.8	25.9	22.9
200 ppm N				
NaNO <sub>3</sub>	377	270	511	478
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	382	294	484	387
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> +NS	276	242	388	394
Urea	317	250	462	365
Urea+NS	253	219	420	362
L.S.D. 0.05	18.3	16.4	22.2	21.1
L.S.D. 0.01	25.1	22.5	30.4	28.9

**\* Micronutrients contents status:**

Data in table (7) indicated that micronutrients contents (Fe, Mn, Zn and Cu) ppm in Jew's mallow as affected by the treatments under studied.

**\* Iron contents status :**

The first section as nitrogen at a rate (100 ppm N). Fe contents indicated that head values were of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> and (Urea) treatments as with cobalt, without inhibitor and the last without cobalt, this values it (4000 and 3375) ppm respectively. Following it were of (Urea) and (NaNO<sub>3</sub>) treatments as with cobalt and without inhibitor values it (3175 and 3125). Increasing rates as a percentage in comparison control (150, 180, 98 and 95) respectively as according to the previous order treatments. As for the second section of table (7) as 200 ppm N. whereas head values were of (Urea +NS) and (Urea) treatments with cobalt with inhibitor and without, its values (3775, 3500), ppm respectively. Following it were of (NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>) and (Urea) treatments as with cobalt and without inhibitor its

values (3298 and 3204) ppm respectively then (NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub> + NS) treatment as with cobalt and with inhibitor and [(NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>] treatment as without cobalt and without inhibitor. Its values (2684 and 2574) ppm respectively increasing rates as a percentage in comparison control (136, 191, 106, 100, 68 and 114) respectively as according to the previous treatments order. Highest increasing rate was to [(NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>] as with cobalt without inhibitor to a rate of nitrogen 100 ppm while with 200 ppm N was (Urea +NS) treatment as with cobalt and with inhibitor. That's means it that cobalt and inhibitor encourage iron uptake especially with ammonium or Urea fertilization may be due to increasing of assimilation process to enzymes and hormones formation and growth of plants.

**\* Manganese contents status:**

The first section of table (7) as (100 ppm N ) indicated that, head value were of (NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>) treatment as without cobalt, without inhibitor and (Urea) treatment as with cobalt, without inhibitor and (Urea+NS) treatment as with Cobalt, with inhibitor

it's values (186 and 132) ppm respectively. Following it were of  $(\text{NH}_4)_2\text{SO}_4$  +NS) treatment as without cobalt, with inhibitor, and (Urea + NS) treatment as with cobalt, with inhibitor, it's values (120 and 112). of Mn contents. Then  $(\text{NaNO}_3)$  treatment as without cobalt, without inhibitor it's values (186,132,120, 112 and 94) ppm of Mn contents respectively. Increasing rates as a percentage in comparison control at previous treatments order as (166,25,71,6 and 34). At the second section as 200 ppm N show that head values were of  $(\text{NaNO}_3)$  as without cobalt, without inhibitor and  $[(\text{NH}_4)_2\text{SO}_4$ +NS] treatment as without cobalt, with inhibitor respectively its values (304 and 192) ppm respectively. Following it  $(\text{NaNO}_3)$  and  $[(\text{NH}_4)_2\text{SO}_4]$  as without cobalt, without inhibitor and  $[(\text{NH}_4)_2\text{SO}_4]$  as with cobalt, without inhibitor, it's values (183 and 162) ppm respectively, then (Urea)

treatment as without cobalt, without inhibitor and (Urea +NS) treatments as without cobalt, without inhibitor and (Urea +NS) treatment as with cobalt, with inhibitor it's values (148 and 143) ppm respectively, highest value was of  $\text{NONO}_3$  treatment as a result  $\text{NO}_3^-$  ion not adsorption on clay surface because it carry of a negative charge and consequently there a bigger chance to cations exchangeable on clay surface therefore the plant there more uptake of manganese (Mn) element.

On the other beside the inhibitor inhibition transformation of ammonium and Urea to  $\text{NO}_3^-$  as a result a nitrification process therefore competition occur between  $\text{NH}_4^+$  ion and  $\text{Mn}^{++}$  on the clay surface of what cause lesser a chance to Mn adsorption.

**Table 7: Micronutrients content (ppm) in Jew's mallow as affected by cobalt and different rates, forms of nitrogen and a nitrification inhibitor.**

Treatments	100 ppmN							
	Without Cobalt				With Cobalt			
	Fe	Mn	Zn	Cu	Fe	Mn	Zn	Cu
Control	1204	70.0	212	29.0	1600	106	220	54.0
$\text{NaNO}_3$	1533	94.0	250	42.0	3125	70.0	156	33.0
$(\text{NH}_4)_2\text{SO}_4$	2500	186.0	300	62.0	4000	65.5	154	36.5
$(\text{NH}_4)_2\text{SO}_4$ +NS	1125	120.0	243	43.0	3000	65.0	119	26.5
Urea	3375	66.0	166	108	3175	132.0	188	37.8
Urea+NS	2340	53.0	155	31.5	3002	112.0	250	50.8
L.S.D 0.05	44.9	9.45	14.9	7.25	54.6	7.92	13.5	5.61
L.S.D. 0.01	61.5	12.9	19.6	9.39	74.8	10.9	18.4	7.68
200 ppm N								
$\text{NaNO}_3$	1600	304	159	52.5	2507	183	267	56.0
$(\text{NH}_4)_2\text{SO}_4$	2574	125	224	73.5	3298	162	209	47.5
$(\text{NH}_4)_2\text{SO}_4$ +NS	1308	192	231	51.0	2684	121	178	39.0
Urea	3500	148	180	33.5	3204	138	206	56.5
Urea+NS	1895	123	110	42.5	3775	143	221	45.0
L.S.D. 0.05	42.6	12.2	12.3	6.49	50.8	10.7	11.3	5.98
L.S.D. 0.01	58.3	16.7	16.8	8.92	69.6	14.7	15.5	8.19

**\* Zinc contents status:**

At the first section of table (7) as (100 ppm N ) indicated to head value were of  $(\text{NH}_4)_2\text{SO}_4$  and  $(\text{NaNO}_3)$  treatments as without cobalt, without

inhibitor and (Urea + NS) treatment as with cobalt, with inhibitor it's values (300 , 250 and 250) ppm respectively. Following it  $(\text{NH}_4)_2\text{SO}_4$ +NS) treatment as without cobalt, with inhibitor. All the differences between treatments were significant under each of

two levels except some little values. Data in the second section as 200 ppm N indicated to head values to Zinc contents were of (NaNO<sub>3</sub>) treatment as with cobalt, without inhibitor and [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>+NS] treatment as without cobalt, with inhibitor, it's values (267 and 231) ppm. Following it [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>] treatment as without cobalt, without inhibitor and (Urea +NS) treatment as with cobalt, with inhibitor it's values (224 and 221) ppm of Zinc content. Then [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>] and (Urea) treatments as with cobalt, without inhibitor, it's values (209 and 206) ppm. Increasing rates as a percentage in comparison control as (21.9, 6, 0.5, 0 and 0) respectively as the previous treatments order. All the differences between treatments were significant under each of two levels except some little values. Highest value was of (NaNO<sub>3</sub>) treatments as without inhibitor of what give a bigger chance on clay surface to cations exchangeable of what lead to more uptake of zinc uptake.

#### \* Copper contents status:

Data in the first section of table (7) as (100 ppm N) indicated to head values were of (Urea) and [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>] treatments as without cobalt, without inhibitor, it's values (108 and 62) ppm of copper (Cu) contents. Following it (Urea+NS) treatments as with cobalt and with inhibitor. Then [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>+NS] treatment as without cobalt, with inhibitor and (Urea) treatment as with cobalt, without inhibitor it's values (43 and 37.8) ppm respectively. All the differences between treatments were significantly under each of two levels except some little value. Highest value was of urea treatment as without cobalt, without inhibitor, at the second section of data as (200 ppm N) head values were of [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>] treatment as without cobalt, without inhibitor and (Urea) treatment as with cobalt, without inhibitor it's values (73.5 and 56.5) ppm of Cu Contents following it (NaNO<sub>3</sub>) treatment as with cobalt, without inhibitor and (NaNO<sub>3</sub>) treatment without cobalt, without inhibitor it's values (56.0 and 52.5) ppm. Then [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>+NS] treatment as without cobalt, with inhibitor and [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>] treatment as with cobalt, without inhibitor it's values (51.0 and 47.5) ppm of Cu contents. Increasing rates as a percentage in comparison control as (153, 5.0, 4.0, 81, 76.0 and 0) respectively, as according to the previous treatments order. Highest value of increasing rates was of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> treatment as without cobalt, without

inhibitor. That's give a bigger chance for others cations exchangeable because the inhibitor encourage continuously of ammonium ion (NH<sub>4</sub>)<sup>+</sup> as not transformation to (NO<sub>3</sub>)<sup>-</sup> ion, thus at absence of cobalt element (Selim, 1987) reported that the effect of the inhibitor was more pronounced at low rather than high N-doses. On the other hand, its decrease of other cations. The effect on micronutrient elements is not noticeable since the plant requirements of such elements are quite low. (Kafakafi and Neumann, 1985) shown that Fe-content seemed to be affected by different N-sources and a nitrification inhibitor. Data revealed that application of sodium nitrate increased concentration of Fe by 34% as compared to control concluded that supplying the plant with as in present of nitropyrin (N-serve) for preventing nitrification reduced Fe chlorosis. Even when ammonium was less than 20% of total mineral N in the soil. Suggesting that NH<sub>4</sub> uptake by plant and consequence of hydrogen (H<sup>+</sup>) efflux occurs from the root solubilizing enough Fe near the root to overcome the chlorosis. (Kagawa *et al.*, 2001) showed that, cobalt level of 2.5 ppm in solution culture increasing Mn, Zn and Cu content in cucumber fruits. These results are in harmony with those of (Liala and Nadia, 2002) clear indicated that, the addition of cobalt resulted in a reduction of Fe which was more or less proportion with the concentration of added cobalt. This indicates the competition between Fe and Co in absorption. This may be explained on the basis of results reported by (Bisht, 1991) and (Blaylock, 1995) that showed certain antagonistic relationships between two elements.

#### \* Residual effect inorganic nitrogen in soil status:

Residual effect inorganic nitrogen in soil as affected by cobalt, different rates and forms of nitrogen and a nitrification inhibitor nitrapyrin (N-serve) were added under effect of Jew's mallow cultivation in an alluvial soil of type clay loam. Data in table (8) indicated that at the first section as (100 ppm N). Head values of total N were of (Urea +NS) and [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>+NS] treatments, this efficiency of inhibitor as ammonium ion NH<sub>4</sub><sup>+</sup> more than nitrate anion NO<sub>3</sub><sup>-</sup> at each of two treatments where as its with inhibitor,



**Table 8: Residual inorganic nitrogen (ppm) in soil after Jew's mallow harvesting as affected by cobalt, different rates, forms of nitrogen and a nitrification inhibitor.**

Treatments	100 ppm N					
	Without Cobalt			With Cobalt		
	NH <sub>4</sub> <sup>+</sup>	NO <sub>3</sub> <sup>-</sup>	Total	NH <sub>4</sub> <sup>+</sup>	NO <sub>3</sub> <sup>-</sup>	Total
NaNO <sub>3</sub>	7.0	13.0	20.0	7.6	12.0	19.6
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	8.9	14.1	23.0	9.8	14.3	24.1
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> +NS	22.0	16.0	38.0	26.0	13.2	39.2
Urea	11.0	14.0	25.0	12.3	12.0	24.3
Urea+NS	30.3	7.7	38.0	30.6	11.1	41.7
L.S.D 0.05	1.83	1.89	2.31	2.03	1.15	2.33
L.S.D. 0.01	2.51	2.21	3.17	2.79	1.57	3.28
200 ppm N						
NaNO <sub>3</sub>	8.0	32.5	40.5	7.20	32.8	40.0
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	12.0	30.0	42.0	15.0	28.3	43.3
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> +NS	35.0	17.0	52.0	29.6	21.6	51.2
Urea	20.6	27.9	48.5	18.3	27.6	45.9
Urea+NS	38.0	17.0	55.0	37.0	20.2	57.2
L.S.D. 0.05	2.18	2.23	2.66	2.63	2.69	3.25
L.S.D. 0.01	3.42	3.06	3.65	3.35	3.97	4.38

Following were of [(NH<sub>4</sub>)<sub>2</sub> SO<sub>4</sub>+NS], (Urea +NS) as without cobalt with inhibitor and (Urea) treatment as without cobalt without inhibitor, values it's (41,7,39,38,38 and 25) ppm respectively of total nitrogen. The lowest values were of (NaNO<sub>3</sub>) treatment without cobalt or with cobalt it's values (20 and 19.6) ppm of total N respectively. From the previous results noticed that the inhibitor protected of soil nitrogen of the loss at form nitrate (NO<sub>3</sub><sup>-</sup>) by the leaching, denitrification and volatilization processes whereas the inhibitor is keeping of nitrogen at form ammonium (NH<sub>4</sub><sup>+</sup>) ion and inhibition transformation its to (NO<sub>3</sub><sup>-</sup>) form. At the second section of table (8) as (200 ppm N). Head values of total nitrogen were of (Urea +NS) treatment as without or with cobalt and with inhibitor it's values (57.2 and 55) ppm respectively. Following it were of [(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>+NS] treatment as without or with cobalt and with inhibitor its values (52 and 51.2) ppm respectively. Then (Urea) treatment as without or with cobalt and without inhibitor respectively. From the previous results at a inclusive look noticed that presence a positive connection between nitrogen rates was added and residual effect of total nitrogen in soil . all the

treatments with inhibitor (N-serve) the residual of total nitrogen in soil was more than the other treatments. Also amounts of nitrogen as form ammonium (NH<sub>4</sub><sup>+</sup>) was higher with inhibitor treatments than amount of nitrate (NO<sub>3</sub><sup>-</sup>) that's as a result the inhibitor effect and it's alone or with cobalt element as was found increasing of total nitrogen at a slight rates than the other treatments which without cobalt treatments. (Abd El Fattah, 1988) showed that the soil treated with (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> and Urea with (N-serve) inhibitor contained 67.6% of the added N, the corresponding values for the (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> and NaNO<sub>3</sub> treatments are 25 and 22%, respectively.

Residual effect of N fertilizer was very high in the former treatment clearly show the economical benefits from using the nitrification inhibitor. (Abd El Fattah, 2008) showed that cobalt element encourage of plant uptake for nitrogen which inter in constitution of dry matter. (Youssef *et al.*, 2001 and Abde EL sabour and Rabie, 2004) reported that cobalt had a stimulating effect on plant growth, cobalt is involved in Co-enzyme and hence is essential for several enzymatic reaction (Khatab and liala, 2002) found that the protein ratio content and

N,P,K and Fe composition of parsley and coriander increased with increasing cobalt concentration up to 25 mg co/kg soil.

#### \* Comment and conclusion:

Indeed the cobalt element using with suitable rates support at improvement of the quantities and qualities properties to the plants especially with nitrogen us fertilizations as increases of plant uptake of macro-micronutrients where contribute increasing of nutrition assimilation and motivates enzymatics hormones plants formation as reflected on the dry matter plants where increase of economic and nutrition value it, on the other beside that the nitrification inhibitor nitrapyrin (N-serve) efficiency at the protection of nitrogen at form ammonium ( $\text{NH}_4^+$ ) fertilizer of the losses. Also the inhibitor had decreases of nitrate accumulation in the plants of through keeping on the nitrogen at form ( $\text{NH}_4^+$ ) ammonium as it inhibition transformation to ( $\text{NO}_3$ ) nitrate which exposes to the losses from soil at the several methods. Therefore, results was recommended that using of nitrogen fertilizer at form ammonium ( $\text{NH}_4^+$ ) or urea with (N-serve) inhibitor and cobalt element at the suitable concentrations according to soil type and plant was cultivated.

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## The Efficacy of Immediate and Delayed Corrective Feedback in the Correct Use of English Definite and Indefinite Articles

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**Abstract:** The process of giving effective feedback is a central concern for teachers and researchers in both first language and second language writing. Many teachers correct students' written errors in the hope that this will help them improve the students' mastery over the correct use of targeted linguistic forms, while Truscott (1996) considered this approach as a misguided endeavour due to his claim that feedback on grammar errors had no place in writing classrooms and it should be abandoned. Regarding this issue, the current study investigated the results of nine weeks treatment on the efficacy of immediate and delayed corrective feedback in the correct use of definite and indefinite articles. Data were collected from a sample of 51 (34 males and 17 females) first year Iranian EFL medical students. The students were administered three rational cloze tests (pre-test, immediate post-test, and delayed post-test). The finding of the study revealed that immediate corrective feedback had a significant effect on the correct use of English articles and the students received corrective feedback significantly improved their ability in using English article system correctly and that they retained this ability when they were given a new test four weeks after the treatment session. This study also indicated that there was a change in article scores across the three different time periods. Thus, the main effect for time was significant.

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**Keywords:** Corrective feedback; Error correction; Definite and indefinite articles

### 1. Introduction

The term corrective feedback (CF) is an umbrella term that covers both explicit and implicit types of feedback in natural and instructional settings. CF is an important task and both teachers and students may benefit it in the writing instruction. CF bridges the concerns of EFL teachers, researchers, and instructional designers. From the last decade onwards, the interest in CF in SLA on both theoretical and pedagogical aspects has been established. There has been a debate on the theoretical side of CF that whether CF is effective and beneficial for language acquisition. Pedagogically, CF has been concentrated in many second and foreign language studies. One of the common findings of these studies is that CF is occurred frequently in the classroom, regardless of pedagogical focus and classroom setting (Fanselow, 1997; Hendrickson 1978), and it is generally agreed that L2 learners expect their teacher to provide them with feedback on their written errors (Enginarlar, 1993; Hedgcock & Lefkowitz, 1994; Lee, 1997; Schulz, 1996). Therefore, the main concern of teachers "is not so much to correct or not to correct" (Lee, 1997, p. 466), but rather when and how to provide feedback on the students' errors (Lee, 2003; Yates & Kenkel, 2002). Regarding conflicting and

different views on effectiveness of error correction practice researchers confront the challenge of whether or not they should abandon all forms of corrective feedback because some very well known studies and experts have provided evidence that corrections do not work (e.g. Truscott, 1996, 1999, 2007, 2008; Sheppard, 1992) while other studies and experts (e.g. Ferris, 1999, 2001, 2004; Lee, 1997, 2004; Hedgcock and Lefkowitz, 1996) have demonstrated that under certain conditions, with certain student populations, and in some contexts, error correction is effective. Investigating this issue has been the main focus of many recent studies. Corrective feedback has been regarded as a controversial topic among researchers and composition theorists for the last three decades (Carrol and Swain, 1993; Dekeyser, 1993; Lyster, 2001; Lyster and Ranta, 1997). It is also assumed as an essential key for the learners in successful language learning. The shift from grammar translation and audiolingualism to communicative language teaching led to conducting research that both support and undervalue the effectiveness of corrective feedback. One trend in discussion on error correction is on whether or not corrective feedback is effective and whether teacher correction can help reduce linguistic errors. Regarding the literature

review on corrective feedback, there are studies that indicate the usefulness and efficacy of error feedback (Ashwell, 2000; Fathman and Whalley, 1990; Ferris 1999, 2003, 2006; Ferris and Roberts 2001). Dana Ferris, was the most proponent of corrective feedback that has argued corrective feedback more extensively. Her main objective seems to provide good evidence for short term learning that results from error correction. To this end, Ferris (1999) referred to Fathman and Whalley's (1990) findings in grammar correction. Ferris (2003) claimed that Fathman and Whalley's (1990) finding was the best evidence available source for the effectiveness of corrective feedback. Ferris (2006) revealed the type of error corrected apparently influence language learning.

Other researchers that found immediate CF was effective in improving the accuracy were Bitchener, 2008; Bitchener and Knoch 2008; Ellis et al. 2008; Ferris and Roberts, 2001; and Sheen, 2006. Russell and Spada (2006) investigated the impacts of corrective feedback on second language grammar learning. The outcome of this study revealed that corrective feedback was helpful for L2 learning. However, there is also research that casts doubt on the benefits of CF (Truscott, 1996, 1999, 2004, 2007). Truscott (2007) claims that research evidence strongly indicates the ineffectiveness of correction. Truscott (2007) believes that error correction has a small effect on learners' ability to write accurately, and he is 95% confident that error correction has very little positive effect, and its effects are very small and uninteresting. Truscott's view on error correction is shared by other researchers in the literature review. Xu (2009) was in agreement with Truscott who was the most potent critic of error correction. Xu (2009) claimed that correction does not contribute the development of accuracy, may even harm the learning process. Repeatedly, Truscott (2008) argued that all the previous works on error correction revealed the short-term effects of treatment. Moreover, some studies do not find error feedback by the teacher to be significantly more effective for developing accuracy in L2 student writing (e.g., Polio, Fleck, and Leder, 1998; Sheppard, 1992). Since EFL students have great diversities of error correction and feedback strategies, a fit for all approach cannot be prescribed for any student. Hence, as Hyland and Hyland address a more constructive approach and a more interactive environment are required for the students. Moreover, "to be effective, feedback should be conveyed in a number of modes and should allow for response and interaction" (Hyland and Hyland, 2006, p. 5).

This study was designed to investigate the following research questions: Q1. Is immediate

corrective feedback effective in increasing the correct use of definite and indefinite articles? Q2. Is the effect of the corrective feedback on increasing the correct use of definite and indefinite articles observable after a period of time?

## 2. Material and Methods

The study used a quasi-experimental design involving two intact classes serving as experimental group (N = 28), and a control group (N = 23). Prior to the experiment, a pre-test was administered to two groups to catch the initial difference between experimental and control groups. The results of the pretest revealed that the experimental and control groups were not significantly different in pre-test. Then, two groups completed, an immediate post-test and a delayed post-test, where all the tests involved a rational cloze test with forty deletions. In addition, two groups wrote three picture stories and completed three error correction tasks during the treatment. The experimental group received corrective feedback on article errors and the control group did not receive direct corrective feedback. Instead, the location of errors made by participants were indicated and underlined and they were asked to do self-correction. In this study, there was a sample of 51 (34 males and 17 females) medical students in two General English I classes. All students were studying medicine in Shiraz University of Medical Sciences and were enrolled in general English classes. The students were all in the first year of study and were taking their second English class at university at the time of this study.

There were six treatment sessions in the current study. The students in experimental and control groups took the same three rational cloze tests (Pre-test, post-test, and delayed post-test). Each of these three cloze tests required students to fill in the blanks with "a", "an", "the" and zero article. The students also did six tasks (three picture stories and three error correction tasks) all in medical contexts, and received feedback on each piece of writing from the researcher as the teacher of the course. Each of the picture stories required the students to describe what was happening in the set of pictures given to the students. Each picture included a setting where different people were doing various activities. Picture one was "Get blood taken", picture two was "Visiting a doctor" and picture three was "Mr. Thin at a dentist's". Moreover, the students in both experimental and control groups completed three error correction tasks that contained sentences with twenty underlined articles. The students were asked to read the whole passages and correct the article errors or tick the correct articles in the parentheses were provided for each article. The researcher made



clear for the students that the tasks would not be assessed and they would not be considered in determining their grades for the course. The students in experimental group received immediate, explicit corrections above the article errors committed by the students, and the students in control group did not receive corrective feedback. The post-test was administered four weeks after pre test. Four weeks after administering post-test, the delayed post-test was given to the students to assess the retention of corrective feedback over time. The schedule for the study is shown briefly in Table.1.

**Table1.** Schedule for the study

Week	Activity
1	Pre-test: 1 <sup>st</sup> Rational Cloze Test
2	Task 1 (A & B)
3	Feedback on Task 1: Task 2 (A & B)
4	Feedback on Task 2: Task 3 (A & B)
5	Feedback on Task 3: Post-test (2 <sup>nd</sup> Rational Cloze Test)
9	Delayed post-test: 3 <sup>rd</sup> Rational Cloze Test

The entire study was continued for a period of 9 weeks. There was a gap of 4 weeks between post-test and delayed post-test when the students in both groups followed their regular classes and the researcher continued teaching the text book for both groups. During these 4 weeks the students did not receive any corrective feedback. To calculate the performance of the students on three rational cloze tests, the students asked to fill in the blanks with appropriate articles. Each blank that was answered correctly was given a credit. Therefore the maximum score was 40 for forty items. The scores for the three rational cloze tests were analyzed by means of repeated measures ANOVA to measure the same subjects under different conditions (or measured at different points in time) (pallant, 2007). To this end, the interaction effect between two variables (time and group), the main effect for each of the independent variable (e.g. time), and the main effect of between-subjects variable were assessed..

### 3. Results

#### 3.1 Descriptive Statistics Results

To answer the Research Questions the mean scores and standard deviations of both experimental and control groups in three rational cloze tests were calculated. The descriptive statistics for both experimental and control groups in pre-test, post-test, and delayed post-test are shown in Table 2, 3, and 4. Table 2 displays the means, standard deviations, minimum and maximum scores. As depicted in Table 2, the means and standard deviations of

different groups were very close together. The comparison between the mean scores among different groups showed that there were no considerable differences among mean scores.

**Table2.** Descriptive statistics for experimental and control groups in pre-test

Groups	N	Mean	SD	Min.	Max.
Experimental	28	16.60	2.55	12	21
Control	23	16.26	3.79	9	23

**Table3.** Descriptive statistics for experimental and control groups in post-test

Groups	N	Mean	SD	Min.	Max.
Experimental	28	18.03	2.92	12	23
Control	23	17.26	4.94	8	26

The minimum and maximum scores obtained in the pre-test were 9 and 23 that were belong to control. As shown in Table 3 the means and standard deviations represented difference between experimental and control groups. The comparison between the mean scores between these two groups revealed that there was considerable difference between the mean scores.

**Table4.** Descriptive statistics for experimental and control groups in delayed post-test

Groups	N	Mean	SD	Min.	Max.
Experimental	28	18	3.43	10	24
Control	23	17.95	3.30	10	25

This table also indicated the experimental group had the higher mean score (mean = 18.03) than the control group (mean = 17.26). The minimum and the maximum scores obtained in the post-test were 8 and 26 in control group. As illustrated in Table 4 the comparison between the mean scores between the experimental and control group revealed that there were no considerable differences between mean scores. This table indicated the mean score for experimental group was (mean = 18) and (mean = 17.95) for control group. The minimum score obtained in the delayed post-test revealed that the minimum score was 10 in two groups while the maximum score was 25 in control group.

#### 3.2 Repeated Measures ANOVA Results

To assess the efficacy of corrective feedback, on the correct use of definite and indefinite articles across three time periods (pre-test, post-test, and delayed post-test) repeated measures ANOVA was run. The results are shown in Table 5. As depicted in

Table 5 the time-group interaction was not statistically significant, Wilk's Lambda = .99,  $F(2,48) = .26$ ,  $p = .77$  partial eta squared = .011. There was a considerable main effect for time, Wilk's Lambda = .83,  $F(2,48) = 4.81$ ,  $P = .012$ , partial eta squared = .167 with both groups showing increase in their scores from pre-test to post-test.

As shown in Table 6 the main effect comparing the two types of intervention was not significant,  $F(1, 49) = .24$ ,  $P = .62$ , partial eta squared = .005, suggesting no significant difference in the effectiveness of corrective feedback.

**Table 5.** Test of within-subjects contrasts

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta squared
Time Wilk's Lambda	.833	4.81	2	48	.012	.167
Time*Group Wilk's Lambda	.989	.260	2	48	.772	.011

**Table 6.** Tests of between-subjects effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	456.32	1	45632.271	1.94	.000	.975
Group	5.709	1	5.709	.244	.624	.005
Error	1148.723	49	23.443			

#### 4. Discussions

Despite Truscott's (1996, 1999, 2004) claims on the ineffectiveness of corrective feedback, it is suggested that researchers and teachers consider corrective feedback as a facilitative factor for improving the students' mastery over linguistic errors and worthwhile spending time and energy. Having said this, it is timely to remind that the finding of this study is not the result of unfocused and random treatment of diverse linguistic errors because different linguistic categories represent separate domains of knowledge and that they are acquired through different stages and processes (Ferris, 1999, 2002; Truscott, 1996). However, it is the result of targeted focus on functional uses of one problematic linguistic error for EFL students. The finding of the study showed that corrective feedback provided had significant effects on the correct use of articles. Hence, it can be concluded that Truscott (1996) was not right when he claimed that giving corrective feedback on linguistic errors is ineffective. However, the findings in this study were the results of focusing on different functions of definite and indefinite

articles that were problematic issues for Iranian EFL students. It should also be admitted that the participants of the study are Iranian medical students that learn English in a place where English is a foreign language and with a few exceptions, the common characteristics of Iranian students is their ability to learn grammar well in formal instructional settings where the focus is usually on form and structure. However, Iranian students also have some problems when they want to use articles correctly. Therefore, further research should be conducted to determine how corrective feedback will be effective in developing the students' mastery over some linguistic structures and how they help them to use them correctly in sentences. The findings of the present study reinforced those of earlier studies (Ashwell, 2000; Bitchener, 2008; Bitchener et al., 2005; Ellis et al, 2008; Fathman & Whalley, 1990; Ferris & Roberts, 2001; Sheen, 2006) of the effectiveness of corrective feedback. Like this study, the findings of earlier studies revealed that corrective feedback provided had a significant effect on the correct use of articles and the students who received

corrective feedback outperformed those who did not receive CF and the students significantly improved their ability in using the targeted functions of the English article system accurately.

The second Research Question investigated the effects of corrective feedback on increasing the correct use of articles after a period of time. To this end, ANOVA revealed that the time was an effective factor and the participants had different performance in different time from pre-test to post-test and delayed post-test. In fact, this study revealed that the students' ability varied significantly across the three times (pre-test, post-test, and delayed post-test). However, it was a linear and upward pattern of improvement from one time to another. While the experimental group faded away on the delayed post-test, it was not significant and the students maintained the same level of ability in the correct use of articles. However, the control group's ability continued to improve from pre-test to post-test, and from post-test to delayed post-test. Even though the performance of the control group improved in the delayed post-test, it was significantly different from that of experimental group. One explanation for this improvement might be that some members of the group received additional input on the targeted feature during the weeks between the post-test and delayed post-test. It is always possible that students in experimental group may have passed on information about what they were receiving feedback on or those students in the control group sought instruction from out of class sources. In this case, the findings of this study not only indicated the immediate effect of different types of corrective feedback but also the extent to which the ability for the correct use of articles was retained after a four-week period without additional corrective feedback and classroom instruction.

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## Species compositions and relative abundance of insect pest associated with some stored cereal grains in selected markets of Maiduguri metropolitan.

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**Abstract:** A survey was conducted from November 2005 to 2006 to determine the species composition and frequency of occurrence of insect pests associated with stored cereal grains in some selected markets in Maiduguri metropolis Borno state- Nigeria. Random sampling methods were used in selecting traders in the markets for the survey. Samples of 1kg of maize, Millet, Sorghum and rice were taken from the stock with the traders for analysis and insect infestation determination. Insect species identified with the grains and their relative abundance in percentages are; *Tribolium castaneum* Herbst 30.9%, *Sitophilus* spp 27.4%, *Rhizopertha dominica* (Fab) 15.2%, *Trogoderma granarium* (Everts) 11.9% and *Cryptolestes* spp (Stephens) 14.7%. The result also indicates that *T. castaneum* and *Sitophilus* spp were more prevalent. The species preference to different grain types in the order *T. castaneum* was dominant in maize and Millet; *Sitophilus* species were dominant in Maize and sorghum, and *Rhizopertha dominica* being the dominant species in Rice.

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**Key words:** Species compositions, relative abundance, stored cereals, Maiduguri metropolitan, *Tribolium castaneum*, *Sitophilus* spp, *Rhizopertha dominica*, *Trogoderma granarium*, *Cryptolestes* spp

### Introduction

Cereal crops are important sources of food for man and his animals. In some parts of the world, cereals provide more than 70% of the energy in human diets (Kumar and Okoronko, 1991; Olomi, 1995). Cereals are however, susceptible to insect pest infestation both in the field and in the store (Adedire and Ajayi, 1996; Ofuye and Lale, 2001; Obeng-Ofori, 2008).

Infestation by insect pest in storage and consequent damage and loss that result from it poses a major threat to global food security especially in resource poor nations (Obeng-Ofori, 2008). Majority of insect pests of stored cereal are cosmopolitan and polyphagous in their feeding behavior (Ofuye and Lale, 2001). This always compounds the food loss problem as it tends to increase the incidence and seriousness of attack.

The abundance of stored cereal insects pests in any locality is to some extent determined by prevailing climatic conditions and grain types stored; and always greater in the tropical storage environment (Hill and Waller, 1990). The attack by insect pests on stored cereals is very critical to food security, because it occurs at points where there is no possibility of compensation (Lale, 1995; Adedire and Ajayi, 1996; Obeng-Ofori, 2008). Informed and timely control strategy is therefore crucial to reduce such unwanted losses.

The knowledge of pest spectrum, distribution and relative seasonal abundance is very vital in implementing any pest management strategy in the stored product environment (Lale, 2002) especially, using the integrated pest management fashion (Don-Pedro, 1989; Obeng-Ofori, 2008). Information on major insect pest associated with stored grain in this part of the country is lacking in literature. This study was designed with the objectives of elaborating information on the biodiversity, distribution and relative abundance of the insects pests infesting stored cereals grains in Maiduguri markets.

### Materials and Methods

**Study site:** the study was carried out from January-December 2006 in three different markets (Baga road, Custom and Monday market) in Maiduguri metropolis In Borno state –Nigeria. Maiduguri lies within the latitudes of 11°51'N, 13°14'N and longitude 10°0'E and 13°40'E. The shares a common border internationally with Tchad and Cameroun Republic.

**Sampling protocols:** Four (4) different types of cereal grains namely; Maize, Sorghum, Millet and rice were obtained from traders stores at each of the selected sites. In each market selected, traders were randomly choosen for sampling purposes. From each selected trader, one (1) Kg of the produce were taken



as sample from bagged produce. The samples were collected with a spear sampler at the middle, top and bottom portion of the bags as described by Hangstrum and Subramanyam (2000). The samples were taken to the Crop Protection laboratory at the university of Maiduguri and sieved to collect the insect present. Live and dead insects were collected, placed in 100ml capacity bottles filled with 90% alcohol and kept for further identification. Insects were sorted according to species and counted for each in each case noting the number.

#### Data analysis

Types and number of insects collected from the study were subjected to descriptive statistics of mean and percentages (%).

### Result and Discussion

The results table 1-3 for the three markets showed that *T. castaneum* and *Sitophilus* spp appeared to be more abundant species. On the overall basis *T. castaneum* has 30.1%, 31% and 32% in Monday, Custom and Baga markets respectively. This therefore implies that *T. castaneum* and *Sitophilus* spp are the most abundant and prevalent primary and secondary pests of most cereals grains in the study area.

Table 4 indicated that maize is more susceptible to insect pests infestation than any of the cereals grains under study. The Table showed that maize has 54.4%, Sorghum 26.2%, Millet 17.2% and Rice 2.2% of relative abundance of infestation. This shows there is some degree of differential susceptibility of the grains to the species found during the survey as the all grains are normally jointly stored in the same store.

The result also indicated all the insect species collected during the study are beetles from the order coleopteran. This agrees with the findings of Appert, 1987; De Lima, 1987; Hill and Waller, 1990; and Ofuye and Lale, 2001 who stated that stored cereal pests that are devastating are insects of the order coleopteran of which both the larvae and the adults does the damage. Others are lesser one of the order lepidopterans where the larvae are pestivorous. This partly explains why lepidoterous species could not be seen during the study because it's only the adults that

were sieved from the grains and identification of the immature stages of insects is very difficult with reasonable degree of certainty ( Ofuye and Lale, 2001 and Obeng-Ofori 2008). Two (2) (*T. castaneum* and *Cryptolestes* spp) out of the five species found are secondary pests while others are primary pest. Since the produce sample are grains, this findings is in line with the general believe that secondary pest are more prevalent on grains that are partly damaged by other species (primary pests) (Imura and Sinha, 1984; Meromick and Stocky, 1993; Xiaosong and Weston, 1995) or by harvesting operations and when the grains are further processed into its products (Odeyemi, 1989; Lale, 2001). The findings also indicate that both the traders and the farmers are prone to experience some serious loss in produce as Adedire and Ajayi, 1996 stated that infestation by some insect pests may commence from the field just before harvest and the weevils continues to reproduce and destroy the grains even in store.

The outcome of this study is very important in planning control as insect monitoring is an important component of pest management in stored products (Hangstrum and Subramanyam, 2000). Economic loss due to insect pest and unnecessary pest management expenses can be minimized or avoided using insect monitoring and decision-making tools such as economic thresholds, predictive models and expert systems to determine the best time to suppress pest populations (Obeng-Ofori, 2008). Similarly, information about the numbers of insects in the samples or the percentages of samples infested is essential in estimating the overall level of insect infestation in the commodity (Obeng-Ofori, 2008). There is therefore an urgent need for a proactive enlightenment campaign directed towards both the farmers and traders in the study area as to the need to adopt integrated pest management strategies to halt the rate of increase in population of the various pest as one of the measure needed to guarantee food security for all people living in those marginal areas. Pest monitoring as means of pest forecasting should be especially encouraged among small holder farmers and traders alike as they are more prone to the impact of the devastating effect of the deleterious activities of the insect pest species.

Table 1: Mean Number of Insect of insects species on cereal grains in Monday market

Cereal grains	<i>Tribolium castaneum</i>	<i>Sitophilus spp</i>	<i>Rhizopertha dominica</i>	<i>Trogoderma granarium</i>	<i>Cryptolestis spp</i>	Total
Maize	22.4	19.4	16.6	13.8	1.4	23.6
Sorghum	9.4	10.6	3.0	1.4	8.8	33.2
Millet	7.6	4.8	1.4	1.2	8.2	23.2
Rice	0.8	0.8	1.0	0.6	0.4	3.6

Table 2: Mean numbers of insects species in custom park market

Cereal grains	<i>Tribolium castaneum</i>	<i>Sitophilus spp</i>	<i>Rhizopertha dominica</i>	<i>Trogoderma granarium</i>	<i>Cryptolestis spp</i>	Total
Maize	23.6	18.8	15.2	11.8	1.6	71.0
Sorghum	9.6	12.2	2.0	1.8	9.2	34.8
Millet	7.2	4.4	1.8	1.6	7.8	22.8
Rice	0.2	0.6	1.0	0.4	0.8	3.0

Table 3: Mean numbers of insects species in Baga road market

Cereal grains	<i>Tribolium castaneum</i>	<i>Sitophilus spp</i>	<i>Rhizopertha dominica</i>	<i>Trogoderma granarium</i>	<i>Cryptolestis spp</i>	Total
Maize	22.8	20.8	13.0	14.4	1.6	72.0
Sorghum	10.0	11.8	2.4	1.4	10.8	36.4
Millet	9.4	3.6	2.2	0.6	6.4	22.2
Rice	0.2	0.4	0.6	0.4	0.6	2.2

Table 4: The mean/percentage composition of insect pests of stored grains in the three markets surveyed.

Insect species	Cereal grains			
	Maize Mean (%)	Sorghum Mean (%)	Millet Mean (%)	Rice Mean (%)
T. Castaneum	22.9 (31.7)	9.7(27.9)	8.1(35.5)	0.4(13.3)
Sitophilus spp	19.7(27.2)	11.5(33.0)	4.3(18.9)	0.6(20.0)
R. dominica	14.9(20.6)	2.5(7.2)	1.8(7.9)	0.9(30.0)
T. granarium	13.3(18.4)	1.5(4.2)	1.1(4.8)	0.5(16.7)
Cryptolestes	1.5(2.1)	9.6(27.6)	7.5(32.9)	0.6(20.0)
Total	72.0(54.4)	34.8(26.2)	22.8(17.2)	3.0(2.2)
Grand total	132.6			

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**Challenges of information and communication technologies (ICT) in rural**<sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi<sup>1,2</sup> Department of Agriculture and Natural Resource, Mahabad Branch, Islamic Azad University, Mahabad, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** This paper is aimed at the analysis of ICT diffusion in rural communities of Lithuania, exploring the main social patterns of diffusion and characteristics of rural Internet users. The study is based on focus group discussions and questionnaire-based survey of Lithuanian rural residents. There are Fundamental challenges about the role of information and communication technologies (ICT) in education. This has led to serious skills shortages in many countries. In turn this has put increasing pressure on policy makers, universities and other training institutions to come up with approaches to inspire young students to choose ICT for their studies. There is also a strong argument for retraining many people who already have pre-service and in-survive education, whether in the workforce or not, to overcome to looming ICT skills crises. This paper reports on the examination of these points. It will also explore appropriate ways to combat this problem through analysis and identification of real prospects for ICT education.

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**Keywords:** information and communication technologies (ICT), education

**Introduction**

It is against this background that the need arose to find out how far we have progressed in the application of ICT in education and what impacts these significant economic investments have had. It is also time to start a value-oriented discussion of how strongly the future of the Iran society—and with it, of education and training— will be linked to the vision of an information society brimming over with technology (Mohseni, 2003).

Technologies (ICT) during the past two decades have had many points of contact with education and training. The development of technology is placing new demands on expertise, and it is also leading to the increased use of information technology (IT) in instruction and learning. As early as in the 1970s discussions of the future of school systems started to pay attention to the opportunities provided by ICT. Now with the approach of the new millennium, IT is playing an increasingly central role in almost all future planning of schools and instruction. (World Bank, 1999).

With the help of state and local funding, information technology has been purchased for schools ever since the 1980s. The state has also found many ways to support teacher training in the use of IT, and it has also allocated funds for the production of IT programs. Instruction in the use of IT has also played an important role in teacher training organized by local school authorities (Becker, 2000).

Although valuable courses may around the world be learned best practices, there is no formula to determine the best level of ICT integration in education system. The main challenges for policymakers, planners, managers, coaches and other

stakeholders that should consider include, is a comprehensive educational policy and planning, infrastructure, language and capacity building and financial affairs. (Collis, 2002).

To achieve promotion and reform in education through ICT, should be considered explicit and clear objectives, guidelines, mobilize the required resources and political requirements for understanding the primary goal in all levels. Some essential elements in planning for ICT are listed below:

1-1-A correct analysis of the current state of education system. ICT impacts should be considered institutionalized as current methods, respectively, and especially "those ICT to drive forward and the barriers should be recognized, as well as those related to education and training programs, infrastructure, capacity building, language and content and finance.( Collis, 2004).

1-2-Educational objectives at different levels of education, as well as various aspects of ICT applications that can best meet these goals in the state be used. Policymakers must understand the potential of ICT in various different goals when the concepts are used.

As well as may alert best practices around the world, about the priority educational needs, financial and Human resources and capacity bottlenecks the country and how these experiences can be adapted to the specific needs of the country (Hakkarainen, 2000).

1-3- Identifying stakeholders and coordinating actions among different interest groups.

1-4- Conducting chosen model based on ICT, should are tested on a small scale, best design models or those who proved they can be used in other areas. Such guidance is essential for identifying, correcting, feasibility, etc.

1-5- Preparation of available financial resources and identify strategies to generate financial resources for strengthening the application of ICT in the long run. (Harris, 1999).

Before any program of based on ICT to run, an Educational technology infrastructure is placed above infrastructure of information and telecommunications. Policy makers and planners should carefully take into account the following:

2-1- At first, is there suitable rooms and buildings for placing technology? Building schools in countries that they are too old, is required to ensure an extensive repair of electrical wiring system, building, cooling and heating, ventilation and safety. (Swaminathan, 2002).

2-2- are there electricity and phone? Developing countries, vast areas still lack adequate power and several miles away their nearest phone station. In some African countries are using wireless technology, although expensive approach, but other developing countries with poor telecommunications can try this solution.

2-3- Policy makers must are examined also attending a variety of ICT in the country in general and the educational system (all levels) in particular. For example, "a primary need in education of based on ICT (using a computer and via online) access to computer and Internet services at the community level, especially schools and host families (Virgo, 2008).

#### **Challenges of Capacity building:**

Various attempts should be occur throughout the educational system integration for success of ICT.

3-1- professional development of teachers should be have five-axis: (Dadgaran, 2002)

- Skills in specific applications
- merging in existing curriculum
- curriculum changes regarding the application of IT (including changes in instructional design)
- Changes in the teacher's role
- to support educational theories

Ideally these should be served in pre-service training of teachers and be upgraded in in-service. In some countries, like Singapore, Malaysia and England, is

required to recognize the application of ICT training courses. ICT will change speedily technologies and in this regard even the most elite teachers need to promote ICT skills and are welcome the latest developments and best practices.

Although the first focus is skills with specific applications but other four focus is importance. Research on ICT application in different fields as education and uniform over the years show disability as a barrier to teachers successfully plan, understand why they should use ICT and how to properly get the best teaching aid. (Falk and Wolfmayr, 2008).

Unfortunately, most teacher professional development in ICT has been the emphasis on teaching tools and their application in education. If learning process being Student centered, anxiety of teachers from being struck by the technology or the loss of authority in the classroom, can be prevented and as a deep understanding and feeling a severe change in their role than do not have to be raised.

Whether ICT will replace teachers? Answer is "no". In fact, with promoting ICT in the classroom, teacher's role in learning process is even more important. What can and should change is the role of teacher. Likewise the role of students "developed since the ICT can be opened classroom doors to the outside world, the community could be a new role in class. (Mohseni, 2003).

Since education is transferred in model centered-teacher to centered-student model, the unique authority of teachers was low and are known more than as facilitators, observers and trainers (of the absolute ruler to guide the way).

Primary task of the teacher is teaching students how to ask questions and to discuss the issue, make hypotheses, and then if necessary to reach Information about finding the issues raised in relation to the assessment. (FAO, 2000).

Because of improved ICT training a new experience, even for teachers, teachers learn educational process and new things are discovered among the students.

Plus this is not unusual to see students in a class based on ICT undertake formal and informal roles of teacher to younger friends and students and sometimes even for teachers. (Saadan, 2001).

Teachers and students from different schools, experts, parents, community and business leaders, politicians and other stakeholders are involved in the educational process areas as resource persons, critic, observer and encouraging.

They also are essential and general customers for student published work on the Web or other media. Not many teachers reluctant to use ICT are especially "computer and internet usage. Hannafin and Savenye were found several reasons for this reluctance:



- Poor design of software,
- pessimism towards Computer effects of increasing efficiency in teaching,
- lack of managerial support,
- the time and efforts to increase technology and learn how to use for training
- Fear of losing authority in the classroom, as class is centered student.

These are points that should be served in pre-service training and professional development programs in in-service training of teachers. In in-service training about professional development of ICT teachers, should in the long run, be flexible and possible. (Cecchini and talat, 2002).

For many teachers lack the necessary conditions, and with less rights in developing countries, adaptation of ICT effectively subject to granting the necessary opportunities for learning things that they need to learn according to their own experience. Motivation of teachers and supporting teachers to pursue professional development plan is necessary. That can be promoted as with ICT initiatives for teachers who are classroom teachers or ensure adequate access to technology is after training.

#### **Current challenges within the language and content:**

English is the dominant language on the Internet. One estimate shows that 80% of online content is English. Also a large share of educational software produced in the world market is in English. A serious obstacle to maximize the use of World Wide Web in developing countries and regions outside the major cities is that English is not prevalent. (Mohseni, 2003).

Even in countries where English is a secondary language (such as Singapore, India, Philippines and Malaysia) is essential that materials the needs of national courses and meet the local content of the curriculum, rather "to create local language be.

Must ensure that the web is a multicultural environment with people of different cultures, namely have a role and a voice in education online communities. Therefore, is essential according to the specific needs of remote and rural segments of cultural and linguistic minorities in general.

#### **Challenges related to financing the cost of ICT:**

One of the biggest challenges in application of ICT in education, balancing educational objectives with economic realities. ICT in educational programs requires massive investment in developing countries that should decide on what models about the current usage of ICT and be cautious and remain vigilant about keeping the economic balance. (Annan, 1997)

Finally, this issue is raised whether application of ICT value added costs to balance or not, the other for any effective ICT-based teaching strategies intended for educational purposes or not, and if there is and scale requirements that can be implemented regardless of existing human and financial resources than that, what does it support? (Dadgaran, 2002). Whyte offers potential sources of financial and ICT applications in following:

1. grant aid
2. the public subsidies
3. private sector funds
4. Support Equipment and volunteers
5. community support (i.e. to putting the house without receiving rent)
6. Members membership fees
7. revenue derived from the central and main tasks:
  - a. Connections (telephone, fax, internet and web page)
  - b. direct access to computer users
  - c. administrative services (photocopiers, audio-visual aids and scan)
8. Subsidiary activities income
  - a. Different services (word processing, preparing financial statements, the preparation, printing and adoption services)
  - b. Educational Services (non face to face training and educational courses)
  - c. social services (conference rooms, social events, local information)
  - d. Works distance and consultation
  - e. specific activities (telemedicine)
  - f. Sale

#### **CONCLUSION**

Many of the ICT training programs based on the charitable agencies aid have been unable to have high durability. Because the government has failed in its financial assistance in this situation none of the local communities to provide resources do not needed to continue these programs. Two strategies in here "to support government and local communities to move" are important. Since the 21st century, is century of education support about youth in Asia, to find sustainable ways to bridge the digital age in Asian countries is a real priority. And work through partnership that local leaders and guides are experts it can be lasting forever.

Several recommendations that emerged from the discussions emphasized on the need to think of ICT in education beyond computer aided learning and

investigate the potential other technologies like community radio and other medium. These mediums could not only be cost effective but also has a greater outreach potential. It was also pointed out that low cost software solutions for e-learning that have scopes for innovation, should be incorporated in large scale projects. With an indication to open source solutions, the sessions recommended that such solutions should become a part of the overall policy for implementing technology supported education interventions.

Sustainability and scalability of project are also issues that needed serious considerations. While moving beyond the pilot and experimental phase, projects especially those that needs a considerable financial contribution should have a viable sustainability model for up scaling. It was also recommended that implementers needs to be cautious when selecting areas for implementing ICT in education projects.

Projects should also not lose priority of the education objectives. In some cases ensuring school accountability system and teachers attendance may be more important than investing time and resources in ICT integration in schools. One fact that emerged in the sessions was that ICTs effectively computers, initiated in government department and schools were being used as decision support in education. Essentially, clear criteria, norms and standards needs to be developed for the information that was being used for decision-making.

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4/1/2011

**Participatory rural appraisal (PRA): New method for Rural Research**<sup>1</sup> Mohammad Abedi, <sup>2</sup> Ali Badragheh<sup>1,2</sup> Department of Agriculture and Natural Resource, Mahabad Branch, Islamic Azad University, Mahabad, Iran\*Corresponding author: [abedi114@yahoo.com](mailto:abedi114@yahoo.com)

**Abstract:** Promising potentials include farmers' own farming systems research, alternatives to questionnaire surveys, monitoring, evaluation and lateral spread by local people, empowerment of the poorer and weaker, and policy review. Changes in personal behavior and attitudes, and in organizational cultures, are implied. PRA parallels and resonates with paradigm shifts in the social and natural sciences, business management, and development thinking, supporting decentralization, local diversity, and personal responsibility. Much of the spread of participatory rural appraisal (PRA) as an emerging family of approaches and methods has been lateral, South-South, through experiential learning and changes in behavior, with different local applications. Rapid spread has made quality assurance a concern, with dangers from "instant fashion", rushing, formalism and ruts. Promising potentials include farmers' own farming systems research, alternatives to questionnaire surveys, monitoring, evaluation and lateral spread by local people, empowerment of the poorer and weaker, and policy review.

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**Keywords:** Participatory Rural Appraisal (PRA)

**Introduction:**

There exist different methods of data collection and analysis, each with its own strengths and weaknesses. Through time, more appropriate and refined methods have been developed. In the context of rural development, information regarding the communities, their livelihoods, their beliefs, the physical environment in which they live, and their resource endowments need to be gathered and interpreted in a manner that identifies their priorities with a view of developing better understanding of their status and designing appropriate intervention projects directed at resolving their problems. The different ways of data collection and interpretation can be seen under two perspectives (IUCN, 2001): qualitative versus quantitative, and participatory versus top down. While the quantitative methods generate information that can be captured numerically, the qualitative methods generally do not generate specific numbers. Qualitative methods are concerned with exploring meanings, processes, reasons, and explanations (Inglis, 1992).

RRA was criticized for being extractive and highly dependent on expert interpretation. It was thus found useful to replace it with PRA which involves a process of learning from, with and by rural people about rural conditions. PRA shares much with its parent, RRA, but is distinguished from it in practice by correcting two common errors: roles of investigation are reversed; and rushing is replaced by relaxation and rapport. At the heart of all these

developments was Robert Chambers, although Paulo Friere has also had strong influence especially in similar developments in education circles (Provention Concertum).

PRA has evolved and spread from beginnings in Ethiopia, India, Kenya, Sudan and elsewhere, and in early 1994 is known to be being quite widely practiced in parts of Bangladesh, Botswana, Ethiopia, francophone West Africa, India, Indonesia, Kenya, Nepal, Nigeria, Pakistan, the Philippines, Sri Lanka, Sudan, Uganda, Vietnam, and Zimbabwe, while starts have been made in at least a score of other countries in Latin America, Africa and Asia. Hundreds of nongovernment organizations (NGOs) have adopted PRA and developed applications, as have a number of government departments. The use of PRA methods is being increasingly explored by students and faculty in universities for research, and by training institutes for fieldwork. Spread appears to be accelerating.

There are six popular techniques/methods that are used to facilitate PRA exercise that enables the community to develop and compile a detailed profile of themselves and their situation.

**• Venn Diagram**

Venn Diagrams are drawn to help understand the current formal and informal institutions in the area under study and the nature of relationship between the communities and these existing institutions and structures. The community is led to identify their needs, analyze these needs and assess the **cause and effect** relationship. This process provides an opportunity for the community to arrive at the most

pressing or priority need utilizing a logical format and this often culminates into a problems tree (Clayton, 1997).

• **Time line**

This technique describes chronologies of events, listing major remembered events in a village with approximate dates. The process involves elderly people in a village to narrate their life history, summarizing major events and changes that have taken place over a period of time. Major events and political regimes including their significance and influence to the change in the lives of the community over time are recorded. Time line shows a broad movement of different aspects in a village during the community's lifetime (Chambers, 1994).

• **Time trend**

This is a technique where people given an opportunity to account about their past and discuss how things close to them have changed. Issues such as ecological history, changes in land-use, cropping patterns, changes in customs, practices & trends in population, migration, education, health, prices, yields, etc. This technique is more precise in giving indication of change (increase or decrease) about a particular item/activity (KGVK, 1991).

• **Mapping**

This is where people use ground, floor or flip charts to map and draw the different aspects of their village e.g. social issues, demographic, resources, health, wealth, literacy, livestock, economic activities, water resources, trees, housing layout etc. This technique portrays the image dwellings in a village (Holland and Blackburn, 1998).

• **Transect Walk**

This is a systematical walk with the Community members through the village observing, discussing, identifying different forms, local techniques, introduced technologies, seeking their uses, problems, solutions and opportunities. It is done to ensure that the team fully explores the spatial differences in the community, assessing the infrastructure that exists and any possible activities that might be taking place within the village.

• **Matrix**

Matrix is a ranking & scoring technique that is used to discover local attitudes and perceptions about a particular resource. This may be about the land use, water conservation measures, seasons, weather conditions, rainfall pattern or rainfall distribution, intensity and efficiency. These are assessed to determine the extent they affect and influence the way of life within the community. This helps to provide a better understanding of constraints and opportunities for possible development interventions. A graph is usually drawn in a matrix format displaying these constraints and opportunities.

Since PRA seeks to assist local people to plan, implement, monitor and evaluate their own action plans, in theory PRA should be used only during the implementation of a project. Since PRA aims at people taking action themselves it is most suited for the community level.

PRA presents a major step forward from RRA. Local people do the analysis and plan for the future. Their own values, needs and priorities are the point of departure. They themselves develop criteria to classify aspects of their life. This not only leads to a better understanding of the situation (for both the in- and the outsiders) and therefore increases the chance for realistic plans, it also generates a much higher commitment of the people to the planned activities (Scrimshaw, 1992).

The many different perspectives on daily reality and the visualisation offer good opportunities to go beyond the most obvious and dominant points of view in the community. The only warning here should be that too much attention to group discussions/ -activities might enable some groups to dominate the discussion (Cornwall, 2008).

The methodology is open to modification; everybody can develop new tools and new ways of organising things. This makes PRA applicable in a very wide range of situations. Indeed, it has been used in both rural and urban areas, both in developing countries and industrial countries, in agriculture, in health care and in social programmes. PRA can also be used to collect data; local people are able to generate and/or collect reliable data which they themselves analyze and use for planning (Mukherjee, 1992).

### Steps in participatory planning

PRA has steps of planning:

1. Defining the objective of PRA
2. Site selection and clearance from local administrative officials. For programmed implantation (or) problem solving purpose. For site selection, use-ranking methods with local people and outsiders; then select the sites for intervention (Ekins, 1992).
3. Preliminary visit
  - Survey team visit
  - Extended discussion with local leaders
  - Agreement to do a PRA
  - Sharing responsibilities with the people
4. Data collection
  - Local people and survey team collect information
  - The data includes:
    - Spatial data
    - Time related information
    - Data on institutions and social structures
    - Technical information

**5. Data analysis**

- PRA team spends days organizing information
- Make large charts and tables of trends, maps transects etc
- Compile a list of all the problems mentioned
- Summarized the problems

**6. Ranking problems**

- Present to the community data collected in a large meeting
- Include line department staff DA s etc
- Rank the problems by discussion and voting

**7. Formulate and rank opportunities**

- From discussion groups on the solutions of the problems
- Obtain advise from the technical officers on:
  - Feasibility
  - Sustainability
  - Productivity
  - Equity of the solutions
- Rank opportunities
- Set an action plans

**8. Adoption of action plans**

- Look for technical information to develop a comprehensive plan
- Specific expert join PRA team
- Line ministry departments take part in the implementation

**9. Implementation**

- All partners in development contributes to activities as:
  - Manpower allocation
  - Materials needed
  - Time needed
  - Funds required(Pretty, 1993)

**PRA are good for:**

- Providing basic information in situations where little is known
- Identifying and assessing problems
- Appraising, designing, implementing, monitoring, and evaluation programs and projects
- Getting a better picture of needs and organizations' ability to meet them
- Developing and transferring appropriate technologies
- Appraising emergencies
- Planning projects that are more relevant, restructuring administrations, assisting in decision-making and policy formation
- Generating hypotheses, ruling out inappropriate ones
- Providing guidelines for survey designs and assessing the applicability of their results to other places.

- Fleshing – out complementing, interpreting, or giving depth and context to information obtained through other methods.

**7.5 PRA is not very useful for:**

Working in situations in which the problem is not usefully addressed at the local or group level, for example, in situations where large-scale structural reorganization is necessary (but even then, local views may help to shape the change).

**PREPARATIONS BEFORE THE PRA:**

Proper preparations determine the success of PRA for it involves learning-by-doing and depends on team contributions. In addition to selecting the site where PRA is to be conducted and collecting secondary information regarding the specific sites and their neighborhoods, it is necessary to:

- Establish a PRA Team;
- Establish a Kuset PRA Committee;
- Conduct Preliminary Visits to the Community;
- Developing PRA Schedule.

**1. The PRA Team:**

The PRA Team consists five faculty members of the faculty of business and economics.

Note that other member(s) already involved in development activities in or near the specified areas shall be included if found necessary, for in PRA, the Team is expected to have the necessary technical know how in different areas (agriculture, health, education, infrastructure, credit, marketing, culture, etc.). It also needs to have a fair gender composition. Although every team member should be familiar with all aspects of the PRA, each team member is also designated for specific tasks which are described as follows(NCAER, 1993):

**a. PRA team leader:** One of the PRA Team members will be designated as a leader in each of the four PRAs. That is one team leader will be assigned for each of the four villages. The team leader will be selected in such a way that four members will alternatively serve as team leaders for each of the four PRAs. The role of the team leader is to(Scoones, 1993):

- Play the leading role in the formation of the village PRA committee;
- Ensure that all preparatory work has been done;
- Make sure that the objectives of each session are achieved;
- Coordinate preparation of the PRA report;
- Resolve any problems which may arise;
- Assign facilitators and note-takers for each session;



- Organize the reports from the note-taker/s into a coherent whole;
- Work as the principal editor of that particular PRA report.

**b. Facilitator:** For each PRA session, one individual should be designated as the lead facilitator (note that the team leader may also serve as a facilitator in some of the sessions). As a key objective of the PRA is to promote active community participation, the role of the facilitator is very important and includes:

**Before the Session:**

- Knowing the contents of their session very well in order that they rarely have to look at the manual for guidance
- Ensuring that the site is well prepared – that there are enough places to sit, that there is not too much noise close by, that the area is well shaded, etc.
- Ensuring that the seating arrangement is good – and that participants can be seated in a circle so that they can see the facilitator, other participants, as well as any flipchart or blackboard which may be used. Important: if participants are not properly seated, have everyone get up and rearrange the meeting place. During the Session
- Ensuring that all participants understand and contribute to the discussions.
  1. If one participant is talking too much, thank him/her for his/her comments and ask another opinion;
  2. If some participants are not contributing at all, ask them directly what they think;
  3. Do not let only one person or a small group of participants dominate the discussions;
  4. Pay special attention to women and the poor who may not feel comfortable contributing.
- Ensuring that team members share their ideas only after the community members have provided their own, and that the team members avoid influencing the community's decisions.
- Managing the time available for the session to ensure that all objectives are achieved.
- At the end of the session, thank participants for their contributions and explain to them the next activity(Drummond, 1992).

**c. Note taker:** Because much information is generated throughout the PRA, the task of taking notes is very important to the program's success. One

person shall be assigned as a note-taker for each session. The role of the note taker includes(Uphoff, 1992):

- Sitting among participants and take notes (it may preferably be done in such a way that the participants are not so aware that someone is taking notes);
- Noting all main discussion points, and paying special attention to the comments of participants concerns:
  1. What they feel are problems;
  2. What they believe are the causes of these problems;
  3. Possible solutions, and especially how the community has solved these problems in the past;
  4. Special beliefs, customs and religious practices.
- Asking participants to repeat comments if they are not well understood;
- Assisting the facilitator by reminding if some important things are left out or not properly taken care of; Copying information presented on big paper into a notebook;
- Reviewing the notes with the facilitator to make sure that they are complete and correct;
- Copy the notes to a laptop at the end of each day's work.

**d. Technical Resource Persons:** Specific team members should be designated to serve as resource persons for key technical areas. If appropriate technical persons are not available with the team, the support of government bureaus or NGOs will be sought(Swift, 1991).

These individuals may serve as facilitators for sessions related to their technical area, or may simply assist the PRA team, the PRA committee or other participants in identifying community problems, causes and possible solutions. Note that even though Technical Resource Persons may have much expertise, they should share their ideas only after community members have discussed their own, and avoid influencing the community's decisions. In addition to focus group discussions, technical persons could be used during transect walk(Appleyard, 1998).

**2. Preliminary Visits to the Community:**

After selecting the specific areas where PRA is to be conducted, the PRA Team (all members need preferably attend) needs to conduct a visit to meet members (local leaders), development workers in the area, government workers, health workers, teachers, and religious leaders with the following duties:

- Introducing the PRA approach to local administrators and community leaders and explaining the objectives of the PRA;
- Explaining the contents and schedule of the PRA program;
- Requesting that a Village PRA Committee be established;
- Deciding on the dates for the PRA;
- Making necessary logistical arrangements, including:
  1. Identifying sites to conduct large and small group meetings;
  2. Discussing lodging arrangements for the PRA Team (if the PRA team decides to stay in the area during the PRA work).

### Conclusion:

The main objectives of the current PRA are:

1. empowerment of rural communities by assisting them to systematically utilize their local knowledge to identify problems and strengths, develop skills of analysis, and design appropriate mechanisms for intervention by themselves and/or by development agents;
  2. advancement of understanding by academicians/researchers of local knowledge and acknowledgement of the capacity of communities to gather data, conduct analysis, and identify as well as prioritize problems and solutions;
  3. utilization of the research questions/problems identified during the PRAs for further investigation;
  4. documenting and presenting the outcomes of the PRAs to development agents (governmental and non-governmental) and other stakeholders so that they could undertake interventions in line with the findings.
- PRA consists of a series of participatory exercises which help community members better assess their history, resources, and overall situation as concerns agriculture, health, marketing, credit, coping mechanisms, education, and other important areas. During the conduct of the PRAs, rural communities in the selected villages will gather information on the resources they already possess; organize their knowledge; share experience among themselves; learn from each other; identify and prioritize local development needs; and develop action plans which respond to these needs.

The many different perspectives on daily reality and the visualisation offer good opportunities to go beyond the most obvious and dominant points of view in the community. The only warning here should be that too much attention to group

discussions/ -activities might enable some groups to dominate the discussion. The methodology is open to modification; everybody can develop new tools and new ways of organising things. This makes PRA applicable in a very wide range of situations. Indeed, it has been used in both rural and urban areas, both in developing countries and industrial countries, in agriculture, in health care and in social programmes. PRA can also be used to collect data; local people are able to generate and/or collect reliable data which they themselves analyze and use for planning.

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**Dimensions of Information and Communication Technologies (ICT) diffusion in rural**<sup>1</sup> Ali Badragheh, <sup>2</sup> Mohammad Abedi<sup>1,2</sup> Department of Agriculture and Natural Resource, Mahabad Branch, Islamic Azad University, Mahabad, Iran

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**Abstract:** In rural Internet and other information communication technologies (ICT) are mainly used by young, educated, well paid and urban consumers. Elderly, low-educated, low-paid and rural residents are among those who use the Internet the least. This great group consistent with men have had active role at areas of social-economic activities and always have had major part on economic production of society. ICT is now recognized as a technological tool which can serve as a catalytic intervention in respect of transforming the lives and livelihoods of rural families. The economic and income divides between urban and rural areas can be overcome only by the technological upgradation of rural professions. In our post-modern network society they are at the risk of social exclusion. This paper is aimed at the analysis of ICT diffusion in rural communities of Lithuania, exploring the main social patterns of diffusion and characteristics of rural Internet users. The study is based on focus group discussions and questionnaire-based survey of Lithuanian rural residents. The paper discusses types of change agents involved in the processes of ICT diffusion in rural communities and the main motives for using the Internet.

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**Keywords:** Information and Communication Technologies (ICT), rural communities, developing countries

**Introduction:**

Information communication technologies as itself do not change the social structure; the force for change is provided by the use of ICT in all spheres of everyday life activities. Information and knowledge we get by means of the Internet empower individuals to participate successfully in nowadays society's life. Thus unequal opportunities to use the Internet and other ICT are tightly related to an issue of social exclusion.

Technologies (ICT) during the past two decades have had many points of contact with education and training. The development of technology is placing new demands on expertise, and it is also leading to the increased use of information technology (IT) in instruction and learning. As early as in the 1970s discussions of the future of school systems started to pay attention to the opportunities provided by ICT. Now with the approach of the new millennium, IT is playing an increasingly central role in almost all future planning of schools and instruction. (World Bank, 1999).

With the help of state and local funding, information technology has been purchased for schools ever since the 1980s. The state has also found many ways to support teacher training in the use of IT, and it has also allocated funds for the production of IT programs.

Instruction in the use of IT has also played an important role in teacher training organized by local school authorities (Becker, 2000).

There are two opposite perspectives on the role of ICT in society. One part of scholars views computers and the Internet as magic entities with the power to transform society. They consider the Internet as a new medium of communication, helping to cope with issues of social exclusion, social inequality. According to Manuel Castells (2002: xxxi), this is one of the reasons "why, after three decades of existence, it emerged from specialized communities in the world of researchers, techies, hackers, and countercultural communities, to catch fire in business and in society at large".

**Approaches to ICT diffusion:**

The diffusion of innovations has been a focus of many research and scientific studies from diverse academic areas (Roger 2003). There were over 1500 diffusion oriented studies even during the 1950s and 1960s and research areas ranged from anthropology, rural sociology, medical sociology to educational or mass media research (Harper 1989:111). As Charles Harper (1989:111) notices, research findings in these diverse areas have been "remarkably consistent and cumulative".

Diffusion theories suggest that there are several types of factors affecting the spread of innovations. Emphasizing different sets of factors, theoretical

perspectives offer the ways how to analyze the dissemination of new technologies, ideas, reforms or products. The recent spread of information communication technologies in society has raised new aspects in diffusion research.

According to Paul Attewell (1996:204), two main metaphors or images are prevalent in diffusion research. He classifies the diffusion theories into 2 main categories: (1) adopter studies, and (2) macro-diffusion theories.

The first group implies theories which explain the patterns of innovation diffusion in relation to communication flows. The diffusion research focuses on adoption by individuals (or by single organizations) and investigates the impact of such factors as the nature of innovation, characteristics of adopters, diffusion networks and other. (Attewell 1996, Harper 1989).

The most widespread theory of innovation diffusion is presented by Everett Rogers. According to this theory, diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers 1983:5), thus the main 4 elements, which are identifiable in every diffusion research study, are (1) an innovation, (2) communication through certain channels, (3) time and (4) members of social system. The first element – innovation - is considered to be any idea, practice, or material artifact perceived to be new by the adopting organization or individual (Rogers 1983). In our case, we analyse ICT communication through certain channels among the members of rural communities.

The potential adopters can find about new ideas just in case they are informed about them, thus the diffusion process implies the second element - communication through certain channels. According to Rogers (1983), innovations such as ICT can be transmitted to the receiver using 2 types of communication channels: (1) interpersonal channels, and (2) mass media channels.

First type implies direct (e.g. face-to-face) communication between transmitter and receiver; and the second type includes governmental policies communicated through TV, radio, newspapers, etc. This existing discourse makes an impact on beliefs and attitudes of people toward ICT use and is one of the means for ICT diffusion among society members. The second group of theories - macro-diffusion theories – examines the diffusion of new technologies across entire populations, communities, society. Speed of adoption depends on such factors as population size of an area, the distance of that area from other centers of population (Attewell 1996:205). John Carey (1996) distinguishes marketplace factors as a separate group in diffusion research. This group

includes pricing policy, replacement cycles. The price of innovation (new product, technology, service, etc.) has an important role in the process of adoption by the public. Generally new products are introduced at a high price, as early manufacturing is more expensive (due to the costs associated with the research and development of the product, low scale of production). As John Carey (1996) argues: a new technology has to find some early users who are able and willing to pay a high price for the product or service in order to achieve the economies of scale in manufacturing that can reduce the price for the general public.

The mass production reduces the costs and the price of the product. Typical examples of such pricing policy are introduction of radio, black white and color TVs, telephone connection. The initial price of the new technology was very expensive for an average household and the technology was not widely used, but the decrease in price resulted in a wider adoption.

But, as John Carey (1996) argues, the personal computer has followed a different pricing pattern: “rather than drop the price of personal computers, manufacturers have increased the capabilities of PCs each year”. Replacement cycles are also important. The growth of some technologies is linked to the purchase of other media. In this sense, replacement cycles for existing media can provide an important way to introduce new media. For example, in U.S. households, the average color TV is replaced after 8 years, the average telephone answering machine after 5 years and the average personal computer after 6 years (Carey 1996).

Information technology is the core element analyzing the new, global, knowledge-based society. In today's world the use of ICT becomes one of the most influential factors that determine both the present performance and the future conditions for the person. The Internet offers a variety of ways for interaction. Lelia Green (2001:197) distinguishes 3 ways of interaction: (1) information access and retrieval, (2) private interactive communication with individuals or small groups and (3) public interactions. But unequal opportunities to use the Internet eliminate this variety of interaction. When we talk about the impact of new information communication technologies on the society, we analyze mainly two aspects of impact– networked or socially excluded people.

Contemporary scientists have formulated the terms like information poor and information rich (Green 2001). An approach like this emphasizes the circumstances of people with access to minimal or large amounts of information. People who do not have or have limited access to information resources



(non-haves of information or information poor) are in the social position lower than information rich. The policies based on the idea of fundamental equity are that all people should have “trouble-free access to information” and this will promote equality (Green 2001:105).

Of course, not everything depends on the access: “Access to technology does not necessarily lead to its use, and information does not necessarily fuel self-empowering activity” (Green 2001:105). As Lelia Green argues: access is a necessary, but by no means sufficient, condition of equitable participation. To talk simply in terms of equity of access ignores the fact that effective interaction in the information society requires high levels of motivation and sustained effort. Such keenness to interact with the technology of information cannot be assumed. Continuing motivation is perhaps the key determinant of successful participation – more important than access per se (Green 2001: 104). The diffusion of ICT and adoption in everyday life activities such as e-learning, ecommerce, e-banking, etc. are rather complicated phenomena, depending on various characteristics of an individual and a certain social system.

Considering the use of the Internet, it is obvious that socio-demographic characteristics determine a gap between different groups of the population. According to the data of a survey Digital Lithuania 2001, performed in the framework of a study Lithuanian Information Society, carried out by The Open Society Fund (Šaulauskas, 2001), the Internet and other information technologies are mainly used by young, educated, well paid and urban consumers. The statistical data of this survey showed that people at the age of 15 – 49, who have acquired higher education or live, or aim at living in Vilnius, Kaunas and other major cities of the country, and have high income are the most involved in the processes of information society development (Šaulauskas, 2001). According to the statistical data, the lowest awareness of the processes and opportunities of information society development is among the Lithuanians over 60, who have acquired secondary or special secondary education, live in villages, rural centres or towns and have rather low income (Šaulauskas, 2001). It is obvious that different socio-demographic characteristics have determined a gap between different groups of the population. This can lead to the information gap, when one part of the population uses digital devices, while the other part of the population is in a digital divide. Thus the residents of rural communities are at the risk of being in a digital divide or even in a social exclusion.

## Conclusions

This study suggests that rural residents consider the Internet as a useful mean and new opportunity for being involved in everyday life processes. But also they indicate some obstacles that ICT diffusion meets in Lithuania. Non-equal ICT infrastructure at regional level, the low number of professionals who maintain the network and provide ICT service in rural regions of Lithuania, lack of knowledge in foreign languages, and relatively high costs of ICT (the prices for the Internet access or personal commuter's both hardware and software) are the main obstacles for rural residents to use the Internet.

Public access is emphasised as one of the ways in making the Internet available to greater numbers of individuals and firms in rural regions of Lithuania. Statistical data show that socially excluded groups (retired, elderly and unemployed people) use the Internet very little or do not use it at all. This case study also suggests that the methodology of the pilot study should be revised, because it is quite complicated to answer the question about the impact of ICT on social exclusion. Data show that people consider that there is a threat of social exclusion of some groups (ICT non-users) in Lithuania. But they are also positive about the role of the Internet in solving problems of exclusion. The use of the Internet is considered as an effective mean to integrate socially excluded people into society's life, because living in rural region is not the key issue for being excluded.

A common strategy in higher education ministries in developing countries is public and private sector partnership in strategy or pursue rapid ICT projects is based. This partnership has different forms such as grant aid private sector interaction with public assistance, donated educational equipment and components by companies to public schools, providing technical assistance for planning, management and consolidation tools and human resources at the local level. But after financial aid, testing programs based on ICT is critical.

Many of the ICT training programs based on the charitable agencies aid have been unable to have high durability. Because the government has failed in its financial assistance in this situation none of the local communities to provide resources do not needed to continue these programs. Two strategies in here "to support government and local communities to move" are important. Since the 21st century, is century of education support about youth in Asia, to find sustainable ways to bridge the digital age in Asian countries is a real priority. And work through partnership that local leaders and guides are experts it can be lasting forever.

Several recommendations that emerged from the discussions emphasized on the need to think of ICT

in education beyond computer aided learning and investigate the potential other technologies like community radio and other medium. These mediums could not only be cost effective but also has a greater outreach potential. It was also pointed out that low cost software solutions for e-learning that have scopes for innovation, should be incorporated in large scale projects. With an indication to open source solutions, the sessions recommended that such solutions should become a part of the overall policy for implementating technology supported education interventions.

Sustainability and scalability of project are also issues that needed serious considerations. While moving beyond the pilot and experimental phase, projects especially those that needs a considerable financial contribution should have a viable sustainability model for up scaling. It was also recommended that implementers needs to be cautious when selecting areas for implementing ICT in education projects.

Projects should also not lose priority of the education objectives. In some cases ensuring school accountability system and teachers attendance may be more important than investing time and resources in ICT integration in schools. One fact that emerged in the sessions was that ICTs effectively computers, initiated in government department and schools were being used as decision support in education. Essentially, clear criteria, norms and standards needs to be developed for the information that was being used for decision-making.

This paper is a multidisciplinary study of ICT initiatives for rural development. It emphasizes adoption of a more systematic approach for integrating Traditional Knowledge Systems (TKS) and ICT inputs to ensure sustainability of rural e-governance projects. The study of literature related to rural development and e-governance has indicated various issues impeding success of such initiatives. The main issues are lack of localization of content for rural communities and inadequate participation of rural communities in design of rural ICT initiatives. The study therefore suggests the use the systems-approach to integrate the relevant TKS along with ICT initiatives in the design of e-governance systems for rural development. This participatory approach can lead to creation of more acceptable and sustainable e-governance projects.

Regardless of the wide differences in ICT access between rich and poor countries and between different groups in the country, there are concerns that challenge the application of ICT in education with the existing differences among the lines of economic, social, cultural, geographic and gender

will be broader. Everyone equal opportunities in terms of suitability for participation are necessary, but access to various factors, either as users or as producers through their sources is difficult and heavy. Therefore, the primary differences enhance and even grow. Consequently, programmers' international education is faced with a difficult challenge and how to help solve the problem and its development.

Promoting ICT in education, when done without careful study, can lead to the marginalization of those with more favorable conditions are unknown. For example, "women compared with men, because of illiteracy, lack of higher education, lack of time and mobility and poverty, controlling access to ICT and fewer opportunities for training are relevant. Also, more boys than girls' access to computers at home and school are not strange to say that if more boys than girls are willing to work with computers. The report of the University Association of American Women is that "Although some girls have an important gender gap have been limited, but today's technology, technology club, and boys in public schools while its own problems and programs are settled girls use computers for word processing the brand".

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**Damage assessment of buildings due to pipeline settlement using fuzzy decision support tool**DINA. A. EMARAH<sup>1\*</sup>, MANAR. M. HUSSEI<sup>1</sup>, HAMD. M. MOUSA<sup>2</sup> AND ADEL. Y. AKL<sup>1</sup>Structural Engineering Department<sup>1</sup>, Faculty of Engineering, Cairo University<sup>2</sup>, Computer Science Department,  
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**Abstract:** Settlement of buildings, due to nearby pipeline deterioration can result in noticeable damage. By combining ground deformation patterns with well-known damage category criteria, the building deformations can be readily assessed without undue oversimplification. In this paper, the well-known computer program ANSYS with geotechnical module “CivilFEM” is used considering linear elastic soil behavior. The finite element model is chosen to investigate the influence of pipeline settlement and burial depth on possible damage of adjacent buildings. Thus, damage category of buildings can be predicted. Also, a fuzzy based assessment system, which evaluates the damage category of buildings was introduced. A criterion to define the membership functions of fuzzy assessment system starting from available information obtained from ANSYS was also described. This results in the prediction of the category of damage of buildings due to the interaction of more than one parameter in pipeline deterioration.

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**Keywords:** Damage category, pipeline, settlement, and fuzzy assessment system.

**1. Introduction**

Due to the high interaction between pipelines deterioration and existing structures in urban areas, pipeline failure draws much attention. Therefore, the influence of pipeline failure on adjacent structures was very important to investigate.

A finite element computer program “ANSYS+CivilFEM”[1], which takes into consideration the elasto-plastic behavior of soil, the pipeline failure mechanisms, and the presence of the structure, was employed to perform the analysis and investigate the general failure mechanisms of soil-structure interaction. This analysis produced a large amount of output data. The paper highlights how the pipeline failure can induce vertical settlements of the foundation of the adjacent structure, which result in noticeable damage of buildings. The report by Aye [2] was used as a basic reference in ground deformation prediction and building damage assessment. For cut-and-cover excavation zone, the work of Peck [3], Clough [4] was used whereas published papers of Burland [5], Boscardin and Cording [6] were applied for bored tunnels. Also, Metwally [7] has evaluated the damage assessment of building due to deterioration of pipelines. The damage categories are based directly on the descriptions of damage provided in Table 1. The cumulative tensile and principal crack widths were calculated from the output settlement run within spreadsheets. The simple cumulative deformation

was used directly considering that the buildings may have exhibited some initial cracking due to construction defects, thermal cracking, or from aging. In addition, the calculation of tensile cracks were calculated at the first bay (from 5.0 to 10.0 m), where the first bay is the nearest place to the pipe failure.

The analysis of the pipeline–structure interaction problem is performed with two steps. The first step (steady state) is concerned with the determination of initial stresses in the soil mass prior to the pipeline failure. The second step (pipeline failure state) deals with the numerical simulation for the failure of the pipeline in presence of the structure. The pipeline failure operation is modeled by settlement of the pipeline. The calculation of damage category by “ANSYS+CivilFEM” software is tedious and time consuming and it doesn’t cover the entire operation range. Therefore, an expert system will be used to predict the degree of damage for different parameters of pipeline failure.

One of the most important applications of expert systems in engineering is fuzzy logic. The fuzzy set theory was developed by Lofty Zadeh [8] in 1965 to deal with imprecise and uncertain Phenomena often presented in real-world applications. It provides [9] a powerful tool for modeling uncertainty associated with vagueness, imprecision and lack of information.

Table 1. Building damage classification after Burland [5] and Boscarding and Cording [6].

Risk Category	Degree of Damage	Description of Typical Damage	Approximate Crack Width (mm)
0	Negligible	Hairline cracks	Null
1	Very Slight	Fine cracks easily treated during normal decoration	0.1 to 1
2	Slight	Cracks easily filled. Several slight fractures inside building. Exterior cracks visible	1 to 5
3	Moderate	Cracks may require cutting out and patching. Door and windows sticking	5 to 15 or a number of cracks > 3
4	Severe	Extensive repair involving removal and replacement of walls, especially over doors and windows. Windows and door frames distorted. Floor slopes noticeably.	15 to 25 but also depends on number of cracks
5	Very Severe	Major repair required involving partial or complete reconstruction. Danger of instability.	> 25 but depends on number of cracks

Consequently, fuzzy logic provides an efficient way of handling the uncertainty for complex systems without sufficient data or only with vague information [10-11]. The fuzzy controller has been used [12] for optimization of the active control of civil engineering structures [13-14-15-16-17]. The main advantages of the fuzzy controller are [14]:

- It is one of the few mathematical model free approaches to system identification and control which makes the system easier to design than developing an accurate mathematical model of the structural system needed for control system design. This can be done by using human experience and expertise to implement the fuzzy controller.
- It tolerates the uncertainties of the input data from wind or earthquake excitations and structural vibration sensors, consequently resulting in a controller system with a sufficient inherent robustness.
- The fuzzy controller can be adaptive by modifying its rules or membership functions and employing learning techniques.

In this study, a fuzzy rule-based decision support system is developed to determine the damage category of a building for a wide range of parameters, depending on crack width and number of cracks obtained from ANSYS model.

## 2. Fuzzy inference methodology

Fuzzy logic [9] is a kind of multi-valued logic utilizing fuzzy sets to perform approximate reasoning. Additionally, a fuzzy rule-based system is a methodology for the interpretation of natural language,

which is essential for linguistic expressions. Fuzzy rules and fuzzy reasoning are the fundamentals of fuzzy inference processes that are utilized to derive meaningful conclusions from ambiguous information [11].

In this context, Fuzzy Inference Systems (FIS), also known as fuzzy rule-based systems, are well-known tools for the simulation of nonlinear behaviors with the help of fuzzy logic and linguistic fuzzy rules. There are currently several popular inference techniques developed for fuzzy systems, such as Mamdani and Assilian [18], and Takagi and Sugeno [19]. Mamdani FIS was selected to be used in this study. In the Mamdani FIS, inputs and outputs are represented by fuzzy relational equations in a canonical rule based form. These linguistic IF-THEN rules are associated with logical connectives, namely AND, OR, ELSE. For example, in the following expression in Eq. (1) the conjunctive (AND) is used as connectives in a fuzzy IF-THEN rule:

$$\text{IF } x \text{ is } A^1 \text{ AND } A^2 \dots \text{ AND } A^N \text{ THEN } y \text{ is } B^l \quad (1)$$

Where: A and B are fuzzy sets with membership functions,  $\mu_A$  and  $\mu_B$ , calculated by a minimization procedure as shown in Eq. (2):

$$\mu_{Bi}(x) = \min [\mu_{A^1}(x), \mu_{A^2}(x), \dots, \mu_{A^N}(x)] \quad (2)$$

Analogously, disjunctive connectives are employed as follows:



IF  $x$  is  $A^1$  OR  $A^2$  ... OR  $A^N$  THEN  $y$  is  $B^1$  (3)

and obtained membership function is given by a maximization procedure as:

$$\mu_{Bi}(x) = \max [\mu_{A^1}(x), \mu_{A^2}(x), \dots, \mu_{A^N}(x)] \quad (4)$$

Another important point that should be explained about fuzzy rule-based systems is how the aggregation of fuzzy rules is performed. It is necessary to obtain an overall conclusion through a consideration of results from each rule. The combination of entire outcomes in a rule-base is referred as the aggregation of fuzzy rules. Similar to the association of fuzzy variables, there are two cases used in the aggregation process, namely conjunctive and disjunctive systems of

rules [10-11]. A graphical representation of a Mamdani inference system with two rules and two crisp inputs is shown in Figure 1. The Mamdani fuzzy inference process gives a two-dimensional solution area, as can be seen in Figure 1. But it is necessary to obtain a single value instead of a region to reach a decision; therefore, the solution should be defuzzified to get a crisp outcome.

There are several methods developed for defuzzification process, such as centroid, weighted average, and center of sums. According to the centroid defuzzification method chosen in this research, a single output ( $X^*$ ) in Eq. (5) can be calculated as follows:

$$X^* = \frac{\int \mu_A(x) \cdot x dx}{\int \mu_A(x) dx} \quad (5)$$

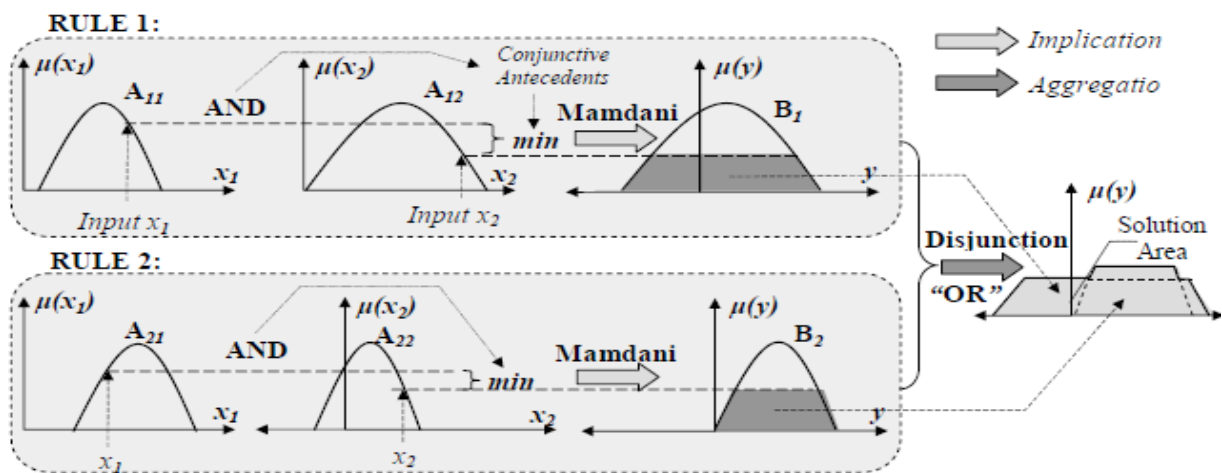


Fig. 1. Graphical illustration of Mamdani inference methodology (for two rules and two inputs) [9].

### 3. Description of basic model

Figures 2 and 3 depict the full three-dimensional geometry model which was used to quantify the interaction between sewer pipeline and the reinforced concrete building with masonry in-fill walls in the coupled analysis. The pipeline comprises 20 pipe segments, where the connections between them are contact element. The type of contact element of pipes connection was taken as “no separation contact element”. In this “no separation contact” element, the two contact surfaces “target and contact surfaces” are tied, although sliding is permitted.

The pipeline is encased in a homogeneous, continuous, and isotropic soil mass. In addition, frictional slip is allowed between pipe and soil. The used data are shown in Table 2. The column's spacing of building in the two directions  $s = 5.0$  m, and height of each level  $h = 3.0$  m. The properties of structural materials taken for deformation and failure prediction calculations are shown in Table 3. The contact element between the foundation of the building and the soil was taken rough element. In this element (rough contact), the two contact surfaces (target and contact surfaces) are not slipping, although separation is permitted.

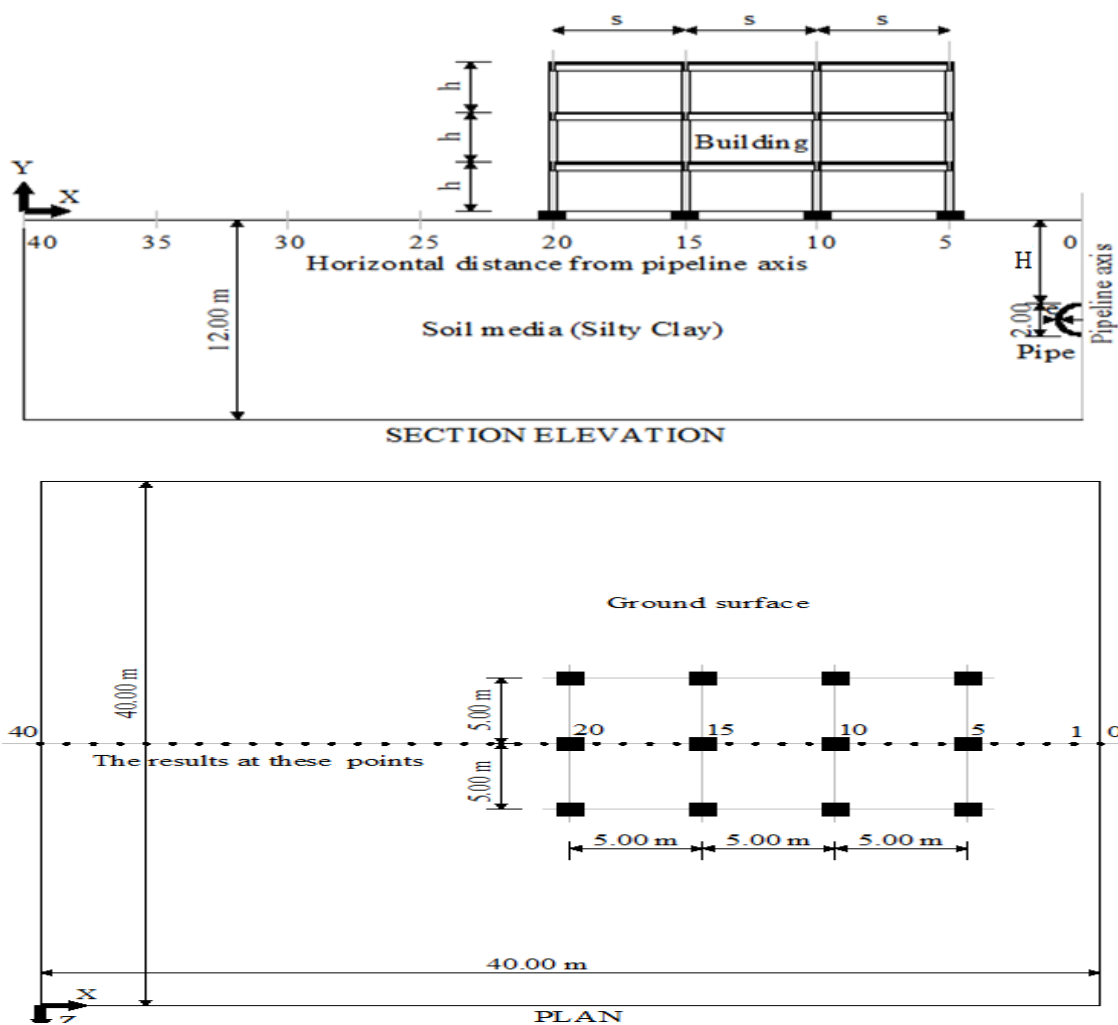


Fig. 2. Geometric model.

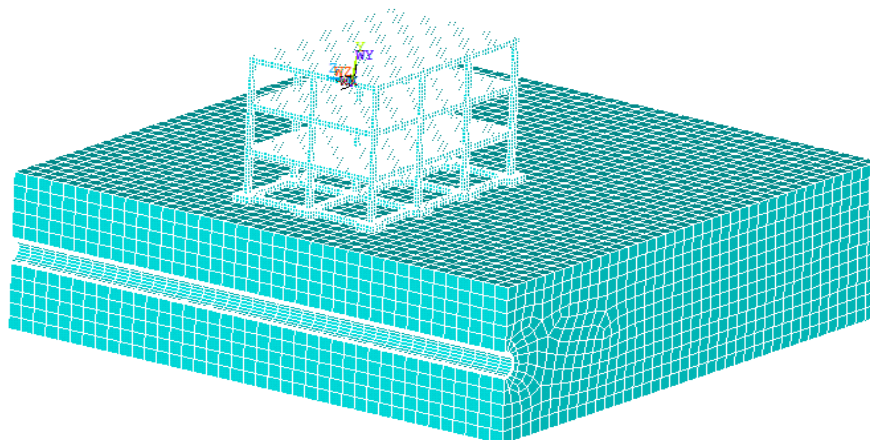


Fig. 3. FEM model.

Table 2. Soil and pipeline properties [7].

Soil properties		Pipeline properties	
Soil elastic modulus $E_s$	2000 t/m <sup>2</sup>	Pipe diameter D (interior)	2.00 m
Soil Poisson's ratio $\nu$	0.35	Wall thickness of concrete e	0.20 m
Soil cohesion C	2.00 t/m <sup>2</sup>	Pipe length $L_p$	2.00 m
Angle of internal friction $\phi$	30°	Number of pipes in pipeline	20 pipes
Density of soil over pipe $\gamma$	1.85 t/m <sup>3</sup>	Concrete elastic modulus $E_c$	3.5E6 t/m <sup>2</sup>
Soil height above crown $H_t$	5.0 m	Concrete Poisson's ratio $\nu_c$	0.20
$\mu$ (Between soil& pipes)	0.32	$\mu$ (Between pipes segments)	0.60

Table 3. Structural material data [7].

Properties	Notation & Unit	Building elements
Density	$\gamma$ (t/m <sup>3</sup> )	2.5
Compressive stress*	$f_c$ (kg/cm <sup>2</sup> )	90
Tensile stress*	$f_t$ (kg/cm <sup>2</sup> )	10.8
Shear stress*	$q$ (kg/cm <sup>2</sup> )	19
Young's modulus	$E$ (t/m <sup>2</sup> )	2.1E06
Poisson's ratio	$\nu$	0.20
compressive strain*	$\epsilon_c$	0.003
tensile strain*	$\epsilon_t$	0.003
Shear strain*	$\epsilon_s$	0.003

\*Allowable stress or strain

#### 4. Influence of pipeline deterioration on building performance

The damaging impact of pipeline settlement on building performance has been shown to be a major problem for urban areas due to high reconstruction and maintenance costs. The assumptions of parametric study of this part are deduced from the practical observations of the deteriorated sewer pipes within the Greater Cairo sewer network [7].

##### 4.1 Influence of pipeline settlement on building

The influence of settlement in the pipelines is explained by considering three values of vertical settlement in the middle six pipe segments; 1% D, 3% D, and 5% D, where D is the pipe diameter. Figure 4 shows the relation between the vertical settlement of building and the pipeline settlement. It

is apparent that increasing the vertical settlement of pipeline leads to the increase of the deformations of the adjacent building.

Table 4 illustrates the results for evaluating the potential damage category for in-fill walls and beams within frames due to different values of pipeline settlement. The results presented in this table show the values of differential settlement, tilting angle  $\alpha$  for the base of building and illustrate the influence of pipeline settlement on the value of crack width. We can find out that, the maximum building deformation and damage at the maximum pipeline settlement. It is clear that the value of pipeline settlement plays an important role in building deformation and damage.

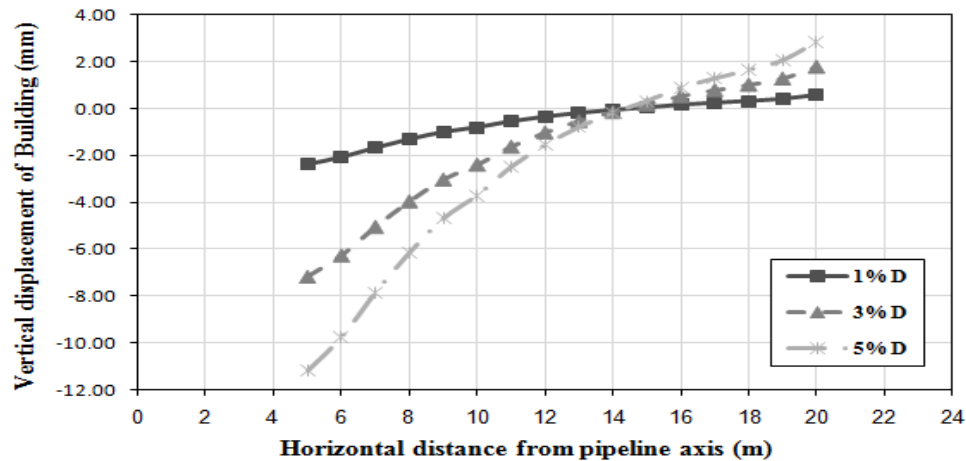


Fig. 4. Influence of pipeline settlement on vertical settlement of building.

Table 4. Evaluation of potential damage in building due to pipeline settlement.

Properties	Case		
	1% D	3% D	5% D
Differential Sett.( $\Delta S$ )	2.94	8.93	14.04
Angle of Tilt ( $\alpha$ ) rad.	0.00020	0.00060	0.00094
Cumulative Maximum Tensile Crack Width ( $C_t$ ) mm	0.88	2.80	4.79
Cumulative Maximum Principal Crack Width ( $C_p$ ) mm	0.81	2.50	4.06
Damage Category	Very Slight	Slight	Moderate

#### 4.2 Influence of burial depth on building

The influence of burial depth is demonstrated by considering three heights of soil above the crown of the pipe; 3, 5, and 7 m. Tables 2 and 3 give the properties of silty clay soil, pipe, and building respectively. The settlement value was fixed as 5% D (D is pipe diameter) in the middle 6 pipe segments. Figure 5 illustrates the influence of burial depth and pipeline settlement on the vertical settlement of building. It is notice that increasing the height of soil above the pipe from 3m to 5m causes increase in building deformations.

Table 5 illustrates the results for evaluating the potential damage category for in-fill walls and beams within frames due to settlement in pipeline and different burial depth. The results presented in this table show the values of differential settlement, tilting angle  $\alpha$  for the base of building and illustrate the influence of different burial depth with settlement in pipeline on the value of crack width. We can find out that, the maximum result of deferential settlement obtained from soil height above pipeline equal 5m. Also, the building damage is increasing by decreasing in the soil height above pipeline.

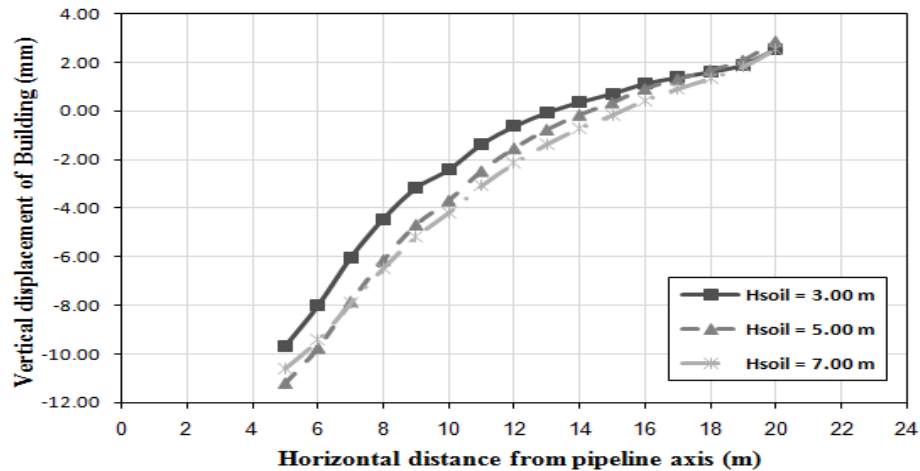


Fig. 5. Influence of burial depth on vertical settlement of building.

Table 5. Evaluation of potential damage to in building due to the burial depth value.

Properties	Case		
	$H_{\text{soil}} = 3\text{m}$	$H_{\text{soil}} = 5\text{m}$	$H_{\text{soil}} = 7\text{m}$
Differential Sett.( $\Delta S$ )	12.25	14.04	13.14
Angle of Tilt ( $\alpha$ ) rad.	0.00082	0.00094	0.00088
Cumulative Maximum Tensile Crack Width ( $C_t$ ) mm	5.98	4.79	2.82
Cumulative Maximum Principal Crack Width ( $C_p$ ) mm	4.55	4.06	2.92
Damage Category	Moderate	Moderate	Slight

## 5. Damage evaluation of building using fuzzy logic tool

One of the most important applications of fuzzy logic is that it can be used for decision process based on available data and knowledge. This study aims to construct a decision support system for damage category of reinforced concrete building structures based on numerical solutions obtained from ANSYS results for a wide range of parameters. Two different variables that have influence on building damage were used as inputs for fuzzy system. Then a procedure using the fuzzy inference methodology was developed to determine the output of a fuzzy system. The global structure of FIS component is depicted in Figure 6.

### 5.1 Fuzzification of pipeline settlement and burial depth

Fuzzy Logic Decision Support Tool (FLDST) is a control law that is described by a knowledge-based system consisting of IF . . . THEN rules with vague predicates and a fuzzy inference mechanism. The rule-base is the main part of the FLDST. It is formed by a family of logical rules that describes the relationship between the inputs (Pipeline Settlement (P.St) and Burial Depth (B.D)) and the output of the fuzzy system (Damage Category of building (D.C)).



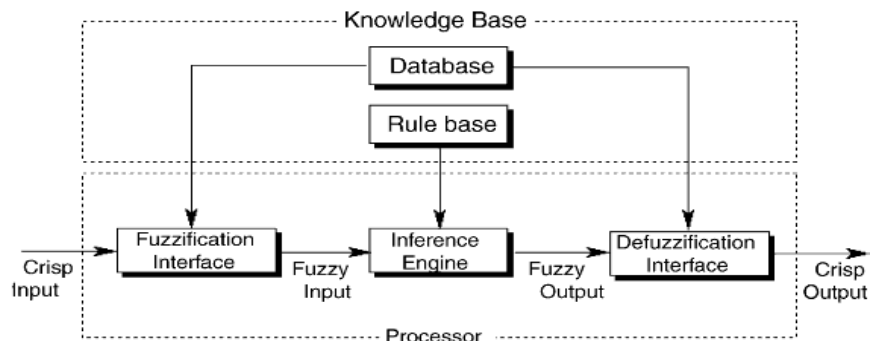


Fig. 6. Fuzzy inference system (FIS) component.

Based on the operator experience, the structure of the FLDST has two inputs and one output. Figure 7 illustrates the proposed structure of FLDST. These inputs are the Pipeline Settlement (P.St) and the Burial Depth (B.D). The data obtained from ANSYS as shown at figure 4 describes the influence of pipeline settlement on vertical settlement of building. We extended the influence of pipe settlement to 10%D and predicted damage at different values of settlement. Five Membership

Functions (MFs) are chosen for the first input (pipeline settlement) where the outer right MF is S function, the outer left is Z function, and the inner three MFs are represented by triangle function as shown in figure 8.a. The linguistic terms for defining the membership functions are: (1%D), (3%D), (5%D), (7%D), and (10%D), where %D is percentage of settlement occurs as a function of pipeline diameter.

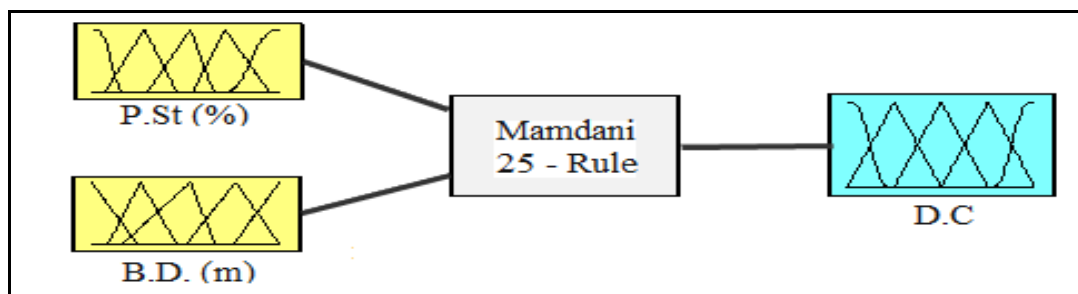


Fig. 7. Structure of FLDST: 2 inputs, 1 output and 25 rules.

The universe of discourse for the second input of FLDST (burial depth) is chosen from 3m to 7m. A five triangle membership functions are chosen to represent linguistic variables of MF and it's defined as (3m), (4m), (5m), (6m), and (7m) as shown in figure 8.b. Finally five membership functions are used to represent the five linguistic variables of output (damage category), the inner three MFs are triangle, the right MF is S function and the left MF is Z function, the name of five linguistic variables of output are: NEG is negligible, VSL is very slight, SL is slight, MOD is moderate and SV is severe as shown in figure 8.c.

## 5.2 Defuzzification of pipeline settlement and burial depth

Once the membership functions and the rule-base of the FLDST are determined, the final

process of the FLDST is to aggregate the fuzzy sets resulting from the inference mechanism to produce a decision (i.e. crisp output), which is the "most certain" in respect of the current system behavior. A number of methods can be used for defuzzification (e.g. center-average, mean-of-maxima), however the most commonly used method is the equation for computation of center-of-gravity (COG), or centroid, which ensures a smooth control action but which requires more complex calculations particularly for non-linear MFs. The membership function for two inputs and single output is shown at figure 8. The 25 rule base was constructed based on data obtained from ANSYS results are shown in Table 6.

Figure 9 illustrates the surface of 25 rules for input MFs and output MFs in three-dimensions.

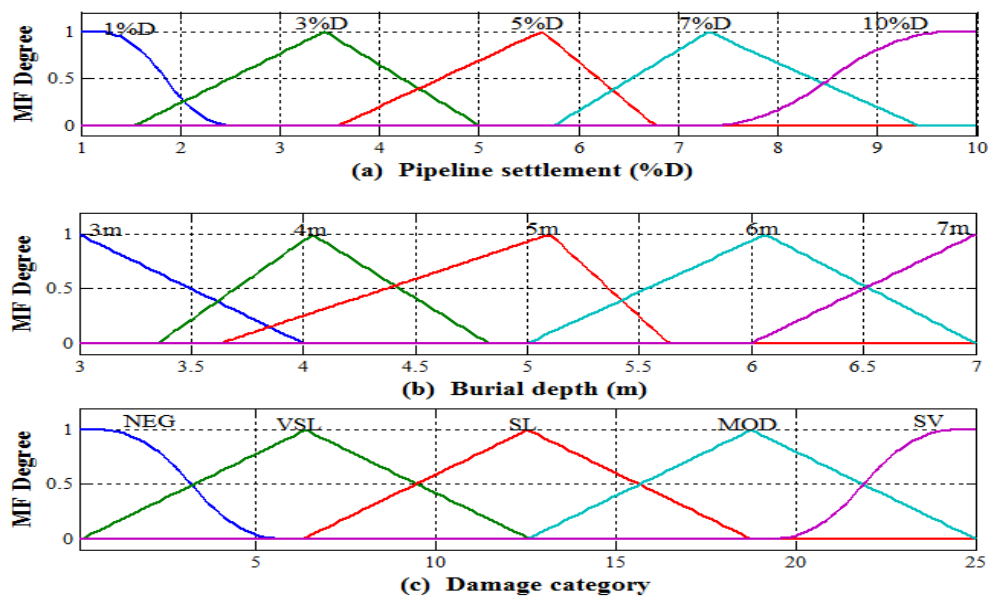


Fig. 8. Membership functions inputs (a), (b) and output (c) of FLDST.

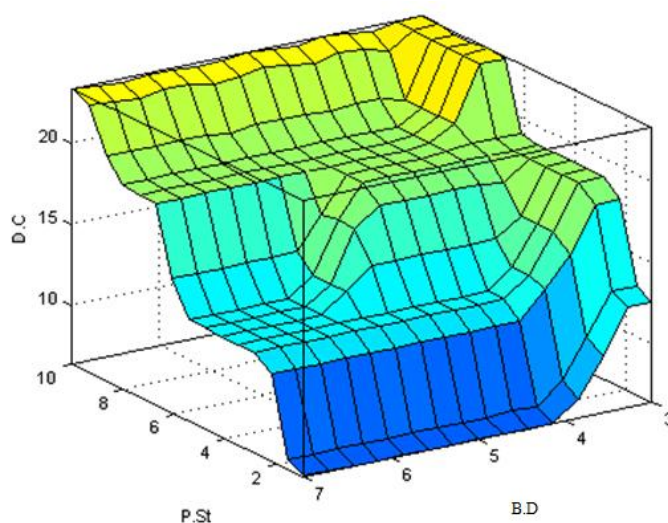


Fig. 9. Surface of 25 rules in three-dimensions.

Table 6. Fuzzy rule base.

		Pipeline Settlement				
		1%D	3%D	5%D	7%D	10%D
Burial Depth	H <sub>soil</sub> = 3m	SL	MOD	MOD	SV	SV
	H <sub>soil</sub> = 4m	VSL	SL	MOD	MOD	SV
	H <sub>soil</sub> = 5m	VSL	SL	MOD	MOD	SV
	H <sub>soil</sub> = 6m	VSL	SL	SL	MOD	SV
	H <sub>soil</sub> = 7m	VSL	SL	SL	MOD	SV

## 5.2 Validation of results

Several examples were run by ANSYS for different pipeline settlement along with different burial depths. The category of damage was similar to the proposed method. Table 7 illustrates several examples from MATLAB that was validated by

ANSYS computer program to validate and evaluate the proposed FLDST in evaluating the damage category of building. The damage category of building based on FLDST is consistent with that obtained from ANSYS calculations.

Table 7. Evaluation of potential damage due to different pipeline settlement along with different burial depths.

IF	Pipeline Settlement	AND	Burial Depth	THEN	Damage Category
	2%D		3.0m		SL
	2.5%D		4.5m		SL
	5%D		7.0m		MOD
	6.5%D		2.5m		MOD
	9%D		6.5m		SV

## 6. Conclusions

The purpose of this study is to present a method for evaluation of the damage category of building due to different parameters of pipeline failure. We chose here two parameters, pipeline settlement and burial depth. It can be concluded from this research that the building deformation is increased due to increase of pipeline settlement, and the increases of the height of soil above the pipeline. Also, the building damage is increased due to increase of pipeline settlement, and the decreases of the height of soil above the pipeline.

The fuzzy decision support tool was constructed for two inputs (pipeline settlement and burial depth) to get the total influence of these two variables on building damage. Moreover, the FLDST has the ability to cover the entire range of pipeline settlement and the burial depth. Accurate results were predicted based on FLDST for wide range of values of pipeline settlement and burial depth. Results were consistent to that obtained from ANSYS calculations.

For future work, it is possible to design similar fuzzy decision support tool for more than two parameters that affect pipeline failure, thus damage of building.

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## Precipitation of Suspended Particles on Tube Walls

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**Abstract:** In this article, the steady state convective diffusion equation for the suspended particles in a suspension is solved for tube flow. Linear concentration drop and uniform axial velocity are assumed. An experiment is designed to measure the concentration at exit and the rate of precipitation on a wall is also measured experimentally after a sufficient time of flow. Accordingly, the diffusion constant is determined and the resulting area of contraction due to this precipitation is calculated and hence the complete blocking time. This model is suggested for fat precipitation on walls of blood vessels in vivo and the precipitation of salt on walls of water tubes in boilers.

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**Keywords:** Precipitation on tube walls, the diffusion coefficient of suspended particles, viscous resistance, Buoyancy neutralizes gravity

### Introduction

Theoretical and experimental investigations are required for the problem of precipitation of suspended particles on the inner walls of tubes carrying rich suspensions of fine particles. Here, we list two important applications of this investigation. The first is the precipitation of fat on the tubes of blood vessels in living humans. The second is the precipitation of salts on the walls of water tubes in boilers. Theoretical derivations are based on steady state conditions, which imply constant values of different parameters in the required experiments, which necessarily extend for long times since the precipitation process is rather slow. Two experiments are needed in this case, determining the diffusion constant and the measurement of the precipitation rate.

As we accept molecular diffusion as the mechanism behind these two phenomena as explained in the Appendix, we look for theoretical estimates. Aside from limitations on viscosity and temperature, the only listed estimate of the diffusion constant is due to Einstein [1] in which he defined the diffusion constant  $D$  as the ratio the thermal activation of particles to its mobility in the medium, i. e.

$$D = \frac{KT}{6\pi\mu a} \quad (1)$$

Where,  $K = 1.3807 \times 10^{-23} \text{ J } ^\circ\text{K}^{-1}$  is the Boltzman constant in Joules per degree Kelvin,  $T$  is the absolute temperature in degrees Kelvin,  $\mu$  is the viscosity of the suspending of the suspending medium in poise,  $a$  is the diameter of the particles in meters,  $KT$  is the thermal activation

and  $6\pi\mu a$  is the mobility of spherical particles and is due to Stoke's [2].

### Literature review:

As far as could be surveyed in literature, only the study of Wang et al. [3] for the computation fluid dynamics approach to the effect of mixing and draft tube on the precipitation Barium sulfate in a continuous stirred tanks could be cited as an analytical study. Next we mention the paper by Chen et al. [4] on the interaction of macro and micro mixing on particle size distribution in reactive precipitation. Manth et al. [5] made experimental investigation of precipitation reactions under homogeneous mixing conditions. At last, we refer to the work of Pohorecki et al. [6] on the use of new model of micro mixing for determination of crystal size in precipitation. Specifically speaking precipitation in narrow tubes could not be cited in literature.

### Formulation of the problem

Now we proceed to design the experiment for determining the diffusion constant and the time of complete blocking of the tube carrying a rich suspension.

Consider a long narrow tube of radius  $r_0$  before precipitation and  $r < r_0$  after precipitation at time  $t$ . The length of the tube is  $L$  and the concentration at inlet is  $C_0$  while due to precipitation this concentration will be  $C < C_0$ , the uniform steady velocity in the tube is  $u$  and the yet unknown diffusion constant is  $D$ .



Since the tube is long relative to its inner radius, we can assume linear concentration gradient with the tube length as

$$\frac{\partial c}{\partial z} = \frac{c_1 - c_0}{L} < 0 \quad (c_1 - c_0) < 0 \quad (2)$$

The equation describing the variation of concentration inside a tube is given by [7]

$$\frac{\partial c}{\partial t} = D \nabla^2 c + \nabla \cdot (c \underline{u}) \quad (3)$$

This is the general equation for convective diffusion. For our case three simplifications are valid:

1. Steady state distribution is time independent ,

$$\frac{\partial c}{\partial t} = 0$$

2. Velocity is uniform inside the tube  $u$  along  $z$  ,

$$\nabla \cdot (c \underline{u}) = u \frac{\partial c}{\partial z} \text{ since velocity is also axial.}$$

3. Linear concentration drop with  $z$  ,

$$\nabla^2 c = \frac{1}{r} \frac{\partial}{\partial r} \left( r \frac{\partial c}{\partial r} \right) \text{ and in this expression}$$

$$\frac{\partial^2 c}{\partial z^2} \text{ vanished for linear drop with } z .$$

The reduced equation for the concentration distribution is

$$\frac{1}{r} \frac{\partial}{\partial r} \left( r \frac{\partial c}{\partial r} \right) = \frac{u}{D} \frac{c_0 - c_1}{L} = \alpha^2 > 0 \quad (4)$$

The first integration of this equation yields

$$\frac{\partial c}{\partial r} = \alpha^2 \frac{r}{2} + \frac{k_1}{r}, \quad k_1 \text{ must be set zero for}$$

bounded  $\frac{\partial c}{\partial r}$  at  $r = 0$  , the second integration

gives  $c(r) = \alpha^2 \frac{r^2}{4}$  for  $c = 0$  at  $r = 0$  ,

which is almost the case. The  $r$  average of  $c$  is given by:

$$\bar{c} = \frac{\alpha^2}{4} \frac{1}{\pi a^2} \int_0^a 2\pi r^3 dr = \frac{a^2 \alpha^2}{8} = c_0 . \text{ Since}$$

we considered the area  $a$  , which is the case at entry before any precipitation. Accordingly

$$c_0 - c_1 = \frac{8 c_0 D L}{a^2 u} \quad (5)$$

Which, is the value of the drop in concentration; the product  $a^2 u (c_0 - c_1) = 8 c_0 D L$  is equal to the precipitation rate and can be measured experimentally measuring the two concentrations  $c_0$  and  $c_1$  at the entry and the exit of the tube and if divided by  $8 c_0 L$  , the coefficient diffusion  $D$  can be estimated as

$$D = \frac{a^2 u}{8 L} \left( 1 - \frac{c_1}{c_0} \right) \quad (6)$$

We proceed now to calculate the variation in radius as  $a$  drop due to precipitation as

$$8 \pi c_0 D L = -L \pi \frac{d r^2}{d t} , \quad \text{which is}$$

integrated  $r^2 = r_0^2 - 8 c_0 D t$  ;  $t$  is the observation time. Complete blocking occurs when

$$r \rightarrow 0 \text{ at } t^* \text{ as } t^* = \frac{r_0^2}{8 D c_0}$$

The results in Equations (6) and (7) are very useful for the applications.

### Comment

In this paper, we succeeded in designing two experiments to measure the precipitation rate and the diffusion constant. Measurements must be made after a sufficient time to ensure the steady state. Initially rich suspensions will help reduce the observation time also long narrow tubes.

The precipitation rate can be obtained by measuring the tube weight before and after the precipitation. Division by the specific weight is necessary if the volume concentration is considered.

### Acknowledgments

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## Appendix

### Analytical verification of Fick's law:

If the relation  $\dot{q} \propto -\nabla c$  between the flux vector  $\dot{q}$  over  $a$  unit area and the concentration gradient  $\nabla c$  exists, The constant  $D$  (the diffusion constant) in Fick's law  $\dot{q} = -D \nabla c$ ,  $D$  is physical. For this purpose, the following model is made.

Consider a cylindrical vessel of unit area and unit height; initially filled with uniform suspension of

concentration  $\frac{1}{2}$ . In the absence of any external force field acting on particle (Buoyancy neutralizes gravity) [8], the conditions on the bottom  $c|_{z=0} = 1$

and  $\left. \frac{\partial c}{\partial z} \right|_{z=0} = 0$  will give the solution of

$$\frac{\partial c}{\partial t} = D \frac{\partial^2 c}{\partial z^2}, \text{ with } c(0, z) = \frac{1}{2} \text{ as [7] :}$$

$$c(t, z) = 1 - \frac{1}{2} \operatorname{erf}\left(\frac{z}{2\sqrt{Dt}}\right) \text{ by similarity, now}$$

let us consider the level  $z = \frac{1}{2}$  for all times, we have

$$c(t, \frac{1}{2}) = 1 - \frac{1}{2} \operatorname{erf}\left(\frac{1}{4\sqrt{Dt}}\right), \text{ this implies}$$

$$2 \left[ 1 - c(t, \frac{1}{2}) \right] = \frac{2}{\sqrt{\pi}} \int_0^{\frac{1}{4\sqrt{Dt}}} e^{-u^2} du.$$

Differentiate both sides with respect to  $t$  then

$$8\sqrt{\pi D} t^{3/2} \frac{dC(t, 1/2)}{dt} = e^{-1/(16Dt)}$$

Both sides are positive and as  $t \rightarrow \infty$ , the  $L.H.S. = 1 = \infty \times 0 = R.H.S.$  as  $C(t, 1/2)$  is constant and therefore  $D$  is physical and we attempt an evaluation for it.

4/2/2011

## Profile of Minimum Drag

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**Abstract:** In this paper a variational integral is constructed for the estimation of the coefficient of minimum drag for axial flow over axi-symmetric bodies of revolution. The unknown equation of the profile is determined by writing

and solving the corresponding Euler-Lagrange equation. This results in the equation  $\frac{y}{c_1} = \frac{\left(1 + \left(\frac{dx}{dy}\right)^2\right)^{\frac{3}{2}}}{-\frac{dx}{dy}}$ . This

reduces to a cubic equation and the real root is obtained by the method of Cardan. The equation of the curve is then obtained by integration. The integral for the Drag coefficient is computed numerically. The profile  $y(x)$  is plotted graphically.

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**Key Words:** Minimum Drag, variational integral, axial, axi-symmetric.

### Introduction:

In aeronautical and marine engineering Drag force on moving bodies must be kept small enough to increase the range and reduce the ejecting force (the release force). Aircrafts and submarines have streamlined shape and conical shaped fronts to ease the fluid flow over. Such bodies are bodies of revolution with their axis of symmetry along the direction of flow. The diameter of the base of the conical front is equal to the diameter of the body to ensure smooth junction. Also, the depth of this conical front is determined by other design and construction parameters.

Drag on bodies of revolution and other bodies' results from the change in momentum of the fluid stream upon attacking the body. Fluid mechanics principles assert that the resistance force  $\underline{F}$  associated with mass flow rate  $\dot{m}$  and caused by change in velocity of the stream  $\Delta \underline{v}$  is equal to  $\underline{F} = \dot{m} \Delta \underline{v}$ . This force is resolved into two components; axial and named Drag  $D$  along the axis of flow and opposite to its direction  $D = \dot{m} \Delta v_{axial}$  and a component called lift force  $L$  normal to the direction of flow and is given by  $L = \dot{m} \Delta v_{normal}$ . In bodies of revolution with axial flow, the integral of the lift force over the surface of revolution is zero due to symmetry [10, pp. 271].

For a jet of velocity  $v$  and mass density  $\rho$  associated with projected area  $A$ , the mass flow rate  $\dot{m} = \rho v A$  the change in velocity  $\Delta v$  along the direction of  $v$  is  $\Delta v = \frac{1}{2} c_D v$  when  $c_D$  a shape factor which is defined as the coefficient of Drag. So the drag force  $D = c_D A \left(\frac{1}{2} \rho v^2\right)$ , where  $\frac{1}{2} \rho v^2$  is defined as stagnation pressure [10, pp. 115]. In this paper we shall obtain the equation of the profile of the head which ensures minimum drag and the corresponding drag coefficient.

### Literature review

The treatment in the present work is based on two basic subjects; axi-symmetric flows and variational methods. Several articles in literature can be found on both subjects.

For the first; namely axi-symmetric flow we mention first the paper by Cumming et al. [1] in which they handled the problem of supersonic turbulent flow computations and drag optimization for axi-symmetric after-bodies. Next we mention the similarity study on mean pressure distributions of cylindrical and spherical bodies by Yeung [2]. Montes and Fernandez [3] studied the behavior of hemi-spherical dome subjected to wind loading. Also, Nelson et al. [4] determined the surface pressure for

axi-symmetric bluff bodies. For the variational methods, we refer to the paper on variational methods, multi-symmetric geometry and continuum mechanics by Marsden et al. [5]. We refer also to the paper by Fernandez et al. [6] on the stress energy-momentum tensors in higher order variational calculus. Next we mention the work by Kouranbaeva and Shkoller [7] on variational approach to second

order multi-symmetric field theory. At last we mention the paper by Lewis and Murray [8] on the variational principles for constrained systems. The minimum drag shape recently treated by by Dong et al.[11] deals with the problem for semi-ellipsoid exposed to shear flow but without obtaining the profile

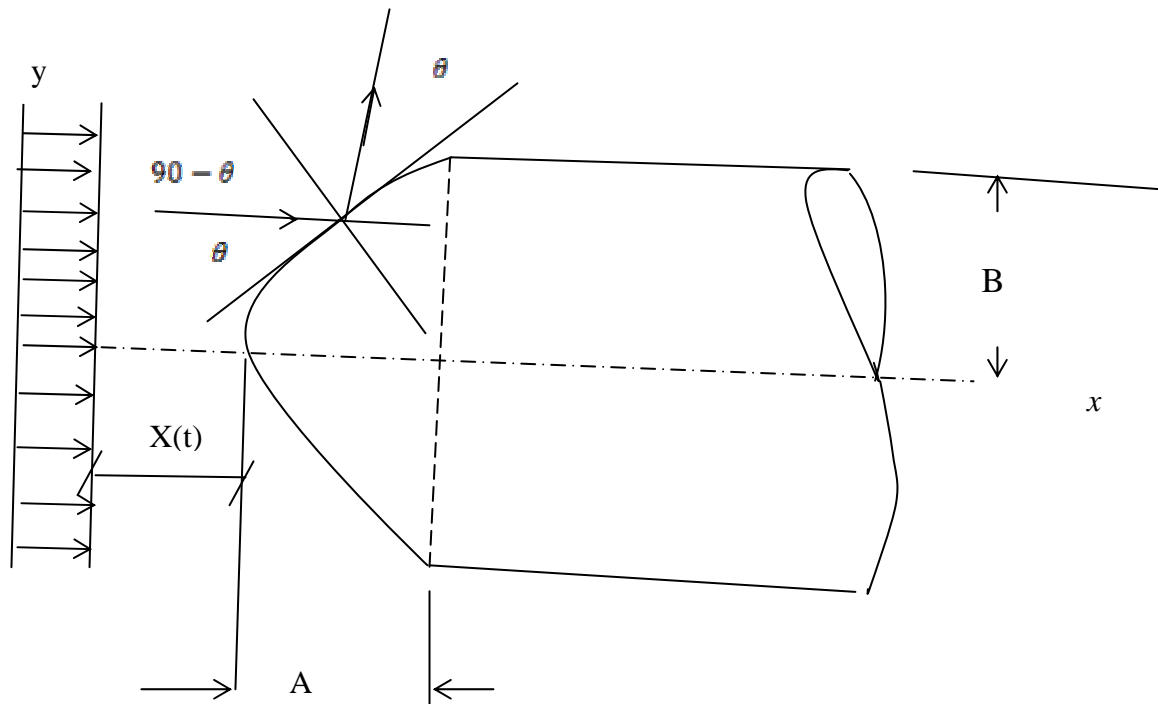


Figure 1: A schematic of the problem

### Formulation of the problem

Consider the body whose axis of symmetry lies along the  $x$  axis. The body is at rest in its frame moving toward the  $y$  axis with its velocity  $v$  in the negative  $x$  direction. Uniform horizontal flow with relative positive velocity  $v$  moving towards the body. The maximum radius of revolution of the body is  $B$  and the head depth is  $A$ . The flow attacks the body and reflects on the surface of the head. We consider frictionless attack so that the angle of attack  $\theta$  equals the angle of reflection. We also consider perfect attack so that the magnitude of the velocity of

attack is equal to the velocity of reflection; both are equal to the relative velocity  $v$ . A schematic of the problem is shown in figure (1).

The change in the horizontal velocity due to attack

$$= v(1 - \cos 2\theta) = 2v \sin^2 \theta = \Delta v$$

The total mass flow rate on the body  $\dot{m} = \rho v \pi B^2$ . The element of drag force on the body  $dD = 2v \sin^2 \theta \rho v dS$  where  $dS = 2\pi y ds$ ; so that  $D = 4\pi \rho v^2 \int_0^B \frac{dy}{ds} y dy$ . Since

$$\frac{dy}{ds} = \frac{1}{\sqrt{\left(\frac{dx}{dy}\right)^2 + 1}}, \text{ we have } \therefore D = 4\pi\rho v^2 \int_0^B \frac{y dy}{\sqrt{\left(\frac{dx}{dy}\right)^2 + 1}}$$

$$\therefore c_D = \frac{8}{B^2} \int_0^B \frac{y dy}{\sqrt{\left(\frac{dx}{dy}\right)^2 + 1}} \quad (1)$$

We are interested in finding the shape  $x(y)$  or  $y(x)$  which minimizes the coefficient of drag  $c_D$

### Solution

We require determining the function  $y(x)$  or its inverse function  $x(y)$  so that the integral  $\int_0^B \frac{y dy}{\sqrt{\left(\frac{dx}{dy}\right)^2 + 1}}$  is minimum. Putting

$$L(y, x, x') = \frac{y}{\sqrt{\left(\frac{dx}{dy}\right)^2 + 1}}, \text{ we require}$$

$$\delta \int_0^B L(y, x, x') dy = 0 \text{ with the relation } x(y) \text{ is not yet determined. The Euler-Lagrange's equation is } \frac{\partial L}{\partial x} - \frac{d}{dy} \frac{\partial L}{\partial x'} = 0 \quad (2)$$

But  $\frac{\partial L}{\partial x} = 0 \therefore \frac{\partial L}{\partial x'} = \text{constant} = c_1$ , where  $x' = \frac{dx}{dy}$

$$\frac{c_1}{y} = -\frac{x'}{(1+x'^2)^{3/2}} \quad (3)$$

Where  $y, x'$  are positive and  $c_1$  is negative and has the unit of distance.

Equation (3) is rearranged to take the form  $Y = (X'^{-\frac{2}{3}} + X'^{\frac{4}{3}})^{\frac{3}{2}}$ , where  $Y = -\frac{y}{c_1}$  and

$X = -\frac{x}{c_1}$ . Now, let  $X'^{\frac{2}{3}} = v$ , leading to  $v^3 - Y^{\frac{2}{3}}v + 1 = 0$ . From [9, pp.9], we get the real root

$$v = \sqrt[3]{\frac{1}{2} + \sqrt{\frac{1}{4} - \frac{Y^2}{27}}} - \sqrt[3]{\frac{1}{2} - \sqrt{\frac{1}{4} - \frac{Y^2}{27}}} = X'^{\frac{2}{3}} \quad (4)$$

Consequently, the ranges of  $Y$  and  $v$  will be

Which is equated to  $c_D \pi B^2 \frac{1}{2} \rho v^2$  to yield

$$0 \leq Y \leq \frac{3\sqrt{3}}{2} = 2.598, \quad 1 \geq v \geq 0$$

From (4), we can write

$$X' = \left( \sqrt[3]{\frac{1}{2} + \sqrt{\frac{1}{4} - \frac{Y^2}{27}}} - \sqrt[3]{\frac{1}{2} - \sqrt{\frac{1}{4} - \frac{Y^2}{27}}} \right)^{\frac{3}{2}}$$

Then

$$X = \int_0^Y \left( \sqrt[3]{\frac{1}{2} + \sqrt{\frac{1}{4} - \frac{Y^2}{27}}} - \sqrt[3]{\frac{1}{2} - \sqrt{\frac{1}{4} - \frac{Y^2}{27}}} \right)^{\frac{3}{2}} dY \quad (5)$$

The integrand is expanded in series up to degree 8 then is integrated<sup>1</sup> to yield

$$X(Y) = Y - \frac{3}{10}Y^{\frac{5}{3}} + \frac{1}{56}Y^{\frac{7}{3}} - \frac{7}{1296}Y^3 - \frac{83}{269568}Y^{\frac{13}{3}} \\ - \frac{179}{1244160}Y^5 - \frac{2093}{76142592}Y^{\frac{17}{3}} + \frac{62441}{4084826112}Y^{\frac{19}{3}} \\ - \frac{70481}{9029615616}Y^7 - \frac{35279105}{3204223598592}Y^{\frac{23}{3}} + \frac{22382693}{20897110425600}Y^{\frac{25}{3}}$$

$$+ O(Y^9) \quad (6)$$

The maximum error is less than  $10^{-3}$ , for the range  $0 \leq Y \leq \frac{3\sqrt{3}}{2} = 2.598$  and

$0 \leq X \leq 1.173$ . This function is plotted in figure 2. The profile curve doesn't pass through (0,0), since  $X'$  is not defined at  $Y=0$

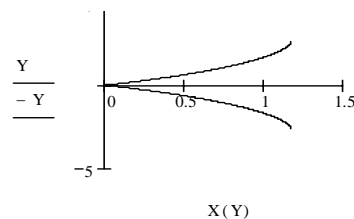


figure 2.a



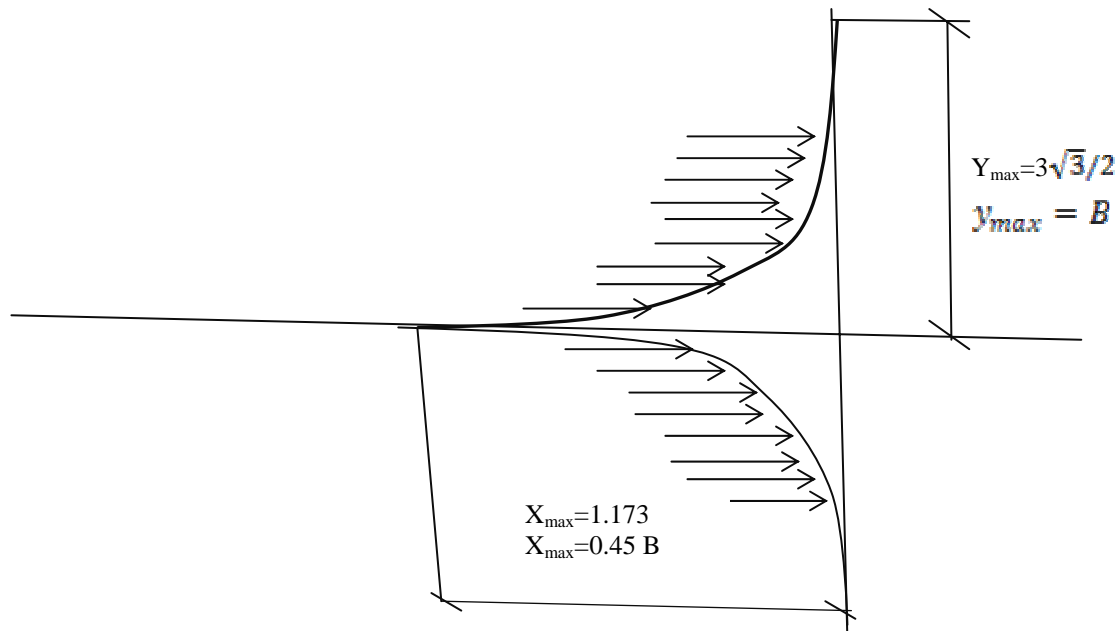


Figure 2 b: Schematic for major dimensions.

**The depth of the profile**

$$y_{max} = -c_1 Y_{max} = B, \text{ then } c_1 = -\frac{2B}{3\sqrt{3}}$$

$$X_{max} = X(Y_{max}) = 1.173$$

$$x_{max} = -c_1 X_{max} = 1.173 \frac{2B}{3\sqrt{3}} = 0.45 B$$

**The drag coefficient:**

Using equation (1)

$$c_D = \frac{8}{B^2} \int_0^B \frac{y dy}{\sqrt{x'^2 + 1}} = \frac{32}{27} \int_0^{3\sqrt{3}/2} \frac{Y dY}{\sqrt{X'^2 + 1}}$$

We recall the value of  $X'^2$  from equation (4), the integrand is finite in the whole range of integration. The above integral is computed using Simpson's rule with 1000 subdivisions and gives  $c_D = 3.78$

**Comment**

The analysis is carried out for invicid flow in the absence of any friction; this requires that the velocities are small enough to prevent turbulence. Very little is available in literature for invicid drag on axi-symmetric bodies; so, comparison with other results was found difficult. The minimum value of

the coefficient of drag for axi-symmetric bodies is found to be 3.78. The value of the drag coefficient for spheres is found experimentally 4 at Reynolds number 10 [10, pp. 271].

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## Stochastic Modeling Compared With Artificial Intelligence Based Approach for Short Term Wind Speed Forecasting

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**Abstract:** The sophisticated Application of Artificial Intelligent Approaches was introduced recently in renewable energy in electric power systems. However, these approaches started with introducing Fuzzy Logic (FL) in the last decades of the last century. Furthermore, Artificial Neural Network (ANN) was introduced to solve many problems in electric power systems. Among these problems is forecasting of wind speed. In this proposed article, the application of Adaptive Neuro-Fuzzy Inference System (ANFIS) is used to forecast the coming speed of wind using real data of the past. The ANFIS can be viewed as a combination of fuzzy system and neural network or fuzzy neural network. This paper aims; firstly, to forecast the average value of wind speed via some well known method. Secondly compare between these different method like Autoregressive Integrated Moving Average (ARIMA), Autoregressive Moving Average form (ARMA), Autoregressive Form (AR). The goal of these methods is to search for the best one compared to Adaptive Neuro Fuzzy Inference System (ANFIS).

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**Keywords:** Adaptive Neuro Fuzzy Inference System (ANFIS), Autoregressive Integrated Moving Average form (ARIMA), Autoregressive Moving Average form (ARMA), Autoregressive Form (AR), Short-Term Load Forecasting.

### 1. INTRODUCTION

Short-Term Forecasting (STF) plays an important role in power systems. Accurate short-term load forecasting has a significant influence on the operational efficiency of a power system, such as unit commitment, annual hydro-thermal maintenance scheduling hydro-thermal coordination, demand side management, interchange evaluation, security assessment and others. The recent developments in the areas of Renewable Energies are promising spots in power systems. Improvements in the accuracy of short-term load forecasts can result in significant financial savings for utilities and co-generators. Various forecasting techniques have been proposed in the last few decades. These models include: time series [2,3], Multiple Linear Regression [4] and Auto Regressive Moving Average (ARMA) [5]. Wind speed were forecasted by the stochastic modelling [6]. However, these result in difficulty in taking system variation into account as the rules are fixed. They do not have the ability to adapt dynamically to the system operating conditions, and to make correct decisions if the signals are uncertain. Recently, intelligent soft computational techniques such as Artificial Neural Network (ANN), Fuzzy Inference System (FIS) [1] and (ANFIS) can model superiority of human

knowledge features. They also reestablish the process without plenty of analysis. Thus these techniques are attracting great attention in an environment that is obvious with the absence of a simple and well-defined mathematical model. Autocorrelation and Cross correlation, both are used in signals and systems analysis. The concept of autocorrelation and cross correlation play an important role. The autocorrelation function of a random signal describes the general dependence of the values of the samples at one time on the values of the samples at another time.

### 2. STOCHASTIC MODELLING

A statistical phenomenon that evolves in time according to probabilistic laws is called a stochastic process. A Stochastic “random” process is a collection, or “ensemble” of functions of time, which might be observed on any trial of an experiment. The ensemble may consist of finite or infinite number of functions. It has been observed that unique patterns of energy and demand pertaining to fast-growing areas are difficult to analyse and predict by direct application of time-series methods. However, these methods appear to be among the most popular approaches that have

been applied and are still being applied to STF. Using the time-series approach, a model is first developed based on the previous data, then future speed is predicted based on this model. The Stochastic Models "Time Series Models" are used in three main areas of application:

- a) Forecasting.
- b) T.F. determination from input – output data.
- c) Stochastic Controller design.

Some of Stochastic Models used in this study will be presented briefly in the next subsections.

#### A. Autoregressive Form (AR):

An autoregressive model (AR) is also known in the filter design industry as an infinite impulse response filter (IIR) or an all pole filter, and is sometimes known as a maximum entropy model in physics applications. There is "memory" or feedback and therefore the system can generate internal dynamics. However, it has a noise term or residue, which is almost always assumed to be Gaussian white noise. Verbally, the current term of the series can be estimated by a linear weighted sum of previous terms in the series. The weights are the autoregression coefficients. The problem in AR analysis is to derive the "best" values for these coefficients given the series. The majority of methods assume the series is linear and stationary. By convention the series is assumed to be zero mean, if not this is simply introducing another term  $a_0$  in front of the summation.

#### B. Autoregressive Moving Average form (ARMA):

Taking the AR model and the MA model, will produce the ARMA model. The notation ARMA(p, q) refers to a model with p autoregressive terms and q moving average terms. This model subsumes the AR and MA models,

#### C. Autoregressive Integrated Moving Average (ARIMA):

The theoretical behaviour of ARIMA processes [7], will be discussed how to use ARIMA models to observed time series data and make forecasts. Before beginning this work, an obvious question needs to be answered. Why should we assume that some random time series can be adequately modelled by an ARIMA process. Many time series are non stationary. The only kind of non stationary supported by the ARIMA model is simple differencing of degree d. In practice, one or two levels of differencing are often

enough to reduce a non stationary time series to apparent stationary. The following procedure will be used to model a time series as an ARIMA process and produce future forecasts:

- 1) Identify the appropriate degree of differencing d by differencing the time series until appears to be stationary.
- 2) Remove any nonzero mean from the differenced time series.
- 3) Estimate the autocorrelation and PACF of the differenced zero mean time series. Use these to determine the autoregressive order p and the moving average order q.
- 4) Estimate the coefficients  $\phi_1, \dots, \phi_p, \theta_1, \dots, \theta_q$ . This can be done in a variety of ways. One simple approach is to make sure that the resulting autocorrelations match the observed autocorrelations. However, a more robust method is maximum likelihood estimation.
- 5) Once the model has been fitted, future forecasts could be produced with associated uncertainties.

By SAS package and using Levenberg-Marquardt (LM) method, some tests are done. Other names might be heard of in the arsenal of optimization include Steepest-Descent method (SD), Conjugate-Gradient (CG) method, Newton's Method, Gauss-Newton method and many others. LM is in nature an improvement Gauss-Newton method by incorporating SD into the iterative update scheme. Steepest-Descent method is the most straightforward method in optimization. By computing the gradient direction followed by a 1D search, SD iteratively approaches the minimum point of the object function in parameter space. Mathematically, SD can be expressed as follows:

$$x^{k+1} = x^k - \lambda^k \nabla F(x^k) \quad (1)$$

where  $\lambda^k = \arg\min F(x^k - \lambda^k \nabla F(x^k))$ . Since only the

first order derivative information is used, SD suffers from the slow convergence. However, it is relatively robust even if the initial guess is far away from the true value. Newton's method goes one step further than SD: in the Taylor's expansion of the object function at the current point, the second order derivative term is now included to compute for the update:

$$x^{k+1} = x^k - [H_F(x^k)]^{-1} \nabla F(x^k) \quad (2)$$

$H_F(x^k)$  in (2) is the Hessian matrix of function  $F(x)$  at  $x^k$  denoting the second order derivative. Newton's method converges faster than SD. The price to pay is the reduction in robustness, i.e. it is much more sensitive to initial guess than SD. Another drawback is the requirement of computing Hessian matrix  $H$  which could be a big issue in many applications where the analytical form of  $F(x)$  is not available. For a specific set of optimization problems - least-square optimization, i.e.

$$\text{Min}F(x) = \|f(x)\|_2^2 = f^T(x)f(x) \quad (3)$$

Gauss-Newton (GN) method is more frequently used. GN is a modified Newton's method by replacing the Hessian matrix  $[H_F(x^k)]$  by the multiplication of two first order derivative (Jacobian matrix) of function  $f$ , so the "pseudo- Hessian" matrix has the form of  $[Jf(x^k)^T Jf(x^k)]$ . The updating equation is now written as:

$$x^{k+1} = x^k - [J_f(x^k)^T J_f(x^k)]^{-1} J_f(x^k)^T f(x) \quad (4)$$

or

$$[J_f(x^k)^T J_f(x^k)](\Delta x)^k = -J_f(x^k)^T f(x) \quad (5)$$

In GN, one only needs to compute  $J_f(x^k)$  which, therefore, leads to the savings in computation. However, it sacrifices the convergence rate (GN has 1-order convergence instead of 2-order as in Newton's method). Both Newton's method and Gauss-Newton method demonstrate oscillatory features during iterations and are not as robust as SD. Levenberg (1944) [8] and Marquardt (1963) [9] provided an hybrid technique of GN and SD. They introduced a steering factor  $\lambda$  to switch between the GN direction and SD direction. The update equation in LM is:

$$[J_f(x^k)^T J_f(x^k) + \lambda I](\Delta x)^k = -J_f(x^k)^T f(x) \quad (6)$$

When  $\lambda \rightarrow 0$ , LM method is reduced to GN. When  $\lambda \rightarrow \infty$ , LM approaches SD method. The values of  $\lambda$  during the iterative process are chosen in the following way: at the beginning of the iterations,  $\lambda$  is set to a large value, so the LM method manifests the robustness of SD and the initial guess can be chosen with less caution. In each iteration, if  $F(x^k + \Delta x^k) < F(x^{k-1} + \Delta x^{k-1})$ , decrease  $\lambda$  by certain amount (say divided by 2) to speed up the convergence; otherwise, increase  $\lambda$  value to enlarge the searching area (trust-region). It has been proven that LM is

equivalent to a Gauss-Newton minimization under a inequality constrain.

### 3. MODELING USING ANFIS

In general, a Fuzzy Logic System (FLS) can be viewed as a non-linear mapping from the input space to the output space. An FLS consists of five main components: fuzzy sets, fuzzifiers, fuzzy rules, an inference engine, and defuzzifiers [6]. However, Fuzzy inference system is limited in its application to only modelling ill defined systems. These systems have rule structure which is essentially predetermined by the user's interpretation of the characteristics of the variables in the model. It has been considered only fixed membership functions that were chosen arbitrarily. However, in some modelling situations, it cannot be discerned what the membership functions should look like simply from looking at data. Rather than choosing the parameters associated with a given membership function arbitrarily, these parameters could be chosen so as to tailor the membership functions to the input/output data in order to account for these types of variations in the data values. In such case the necessity of the Adaptive Neuro Fuzzy Inference System (ANFIS) becomes obvious. Adaptive Neuro-fuzzy networks are enhanced FLSs with learning, generalization, and adaptive capabilities. These networks encode the fuzzy if-then rules into a neural network-like structure and then use appropriate learning algorithms to minimize the output error based on the training/validation data sets. Neuro-adaptive learning techniques provide a method for the fuzzy modelling procedure to learn information about a data set. It computes the membership function parameters that best allow the associated fuzzy inference system to track the given input/output data. A network-type structure similar to that of a Artificial Neural Network (ANN) can be used to interpret the input/output map. Therefore, it maps inputs through input membership functions and associated parameters, and then through output membership functions and associated parameters to outputs. The parameters associated with the membership functions changes through the learning process. The computation of these parameters (or their adjustment) is facilitated by a gradient vector. This gradient vector provides a measure of how well the fuzzy inference system is modelling the input/output data for a given set of parameters. When the gradient vector is obtained, any of several optimization routines can be applied in order to adjust the parameters to reduce some error criteria. This error criterion is usually defined by



the sum of the squared difference between actual and desired outputs. ANFIS in the MATLAB program uses a combination of least squares estimation and back propagation for membership function parameter estimation. Furthermore the used ANFIS is assumed to have the following properties [10]:

- It is zero th order Sugeno-type system.
- It has a single output, obtained using weighted average defuzzification. All output membership functions are constant.
- It has no rule sharing. Different rules do not share the same output membership function, namely the number of output membership functions must be equal to the number of rules.
- It has unity weight for each rule.

Figure (1) shows the architecture of the ANN, while Figure (2) shows the architecture of the ANFIS. ANFIS is comprising by input, fuzzification, inference and defuzzification layers. The network can be visualized as consisting of inputs, with N neurons in the input layer and F input membership functions for each input, with F\*N neurons in the fuzzification layer. There are F^N rules with F^N neurons in the inference and defuzzification layers. It is assumed one neuron in the output layer. For simplicity, it is assumed that the fuzzy inference system under consideration has two inputs x and y and one output z as shown in Figure (1). For a zero-order Sugeno fuzzy model, a common rule set with two fuzzy if-then rules is the following Rule Set:

IF ( x is A ) AND ( x is B ) THEN  $f_1 = p_1 x_1 + q_1 x_2 + r_1$  (7)

IF ( x is A ) AND ( x is B ) THEN  $f_2 = p_2 x_1 + q_2 x_2 + r_2$  (8)

#### ANFIS Characteristics [10]:

L0: State variables are nodes in ANFIS inputs layer  
L1: Term sets of each state variable are nodes in ANFIS values layer, computing the membership value

L2: Each rule in FC is a node in ANFIS rules layer using soft-min or product to compute the rule matching factor i

L3: Each i is scaled into in the normalization layer

L4: Each weighs the result of its linear regression fi in the function layer, generating the rule output

L5: Each rule output is added in the output layer

Layer 1: Calculate Membership Value for Premise Parameter

- Output  $O_{1,i}$  for node  $i=1,2$   
 $O_{2,i} = W_i = \mu_{A_i}(X_1)$  (9)

- Output  $O_{1,i}$  for node  $i=3,4$

$$O_{2,i} = W_i = \mu_{A_i}(X_1) \quad (10)$$

Where

A is a linguistic label (small, large, ...)

Node output: membership value of input

Layer 2: Firing Strength of Rule.

Use T-norm (min, product, fuzzy AND)

$$O_{2,i} = W_i = \mu_{A_i}(X_1) \mu_{B_i}(X_2) \quad (11)$$

(for  $i=1,2$ )

Node output: firing strength of rule

Layer 3: Normalize Firing Strength

Ratio of ith rule's firing strength vs. all rules' firing strength (for  $i=1,2$ )

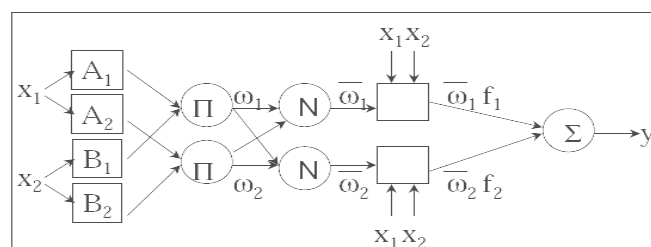


Figure (1) : The Architecture of The ANN

#### 4. Simulation Scheme And Result

It is possible to use a graphics user interface, Command *anfisedit* [11]. It is also possible to use the command line interface or m-file programs. There are functions to generate, train, test and use these systems.

Layers: 0 1 2 3 4 5

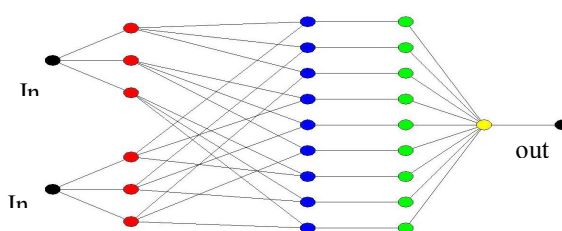


Figure (2) : The Architecture of The ANFIS

Three triangle membership function were used in input by selecting it in ANFIS module then choose output as linear and choose what the number of Epochs as a limiter for the iterations will be used in the training. Based on test data, it is easily to conclude that the result is very good by comparing it with the speed reading in the coming day [12]. Figure (3) illustrates the original data and how these data changed via days. And Figure (4) show the regression forecasting data and ARIMA forecast after regressed by SAS program. Figures

(5) ,(6) show the auto correlation and partial auto correlation of these data respectively. While Figure (7) presents the changes of predict ,lower and upper limit and original data using SAS package [14]. From this model the next value of speed could be found using Matlab [15] M-file as well as using SAS Package [14].

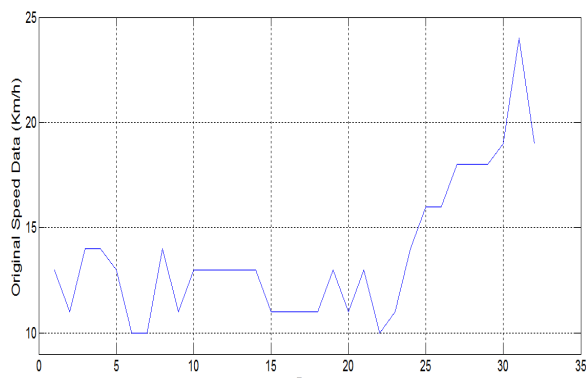


Figure (3) : The Changes Original Data [12] With Days Of One Month

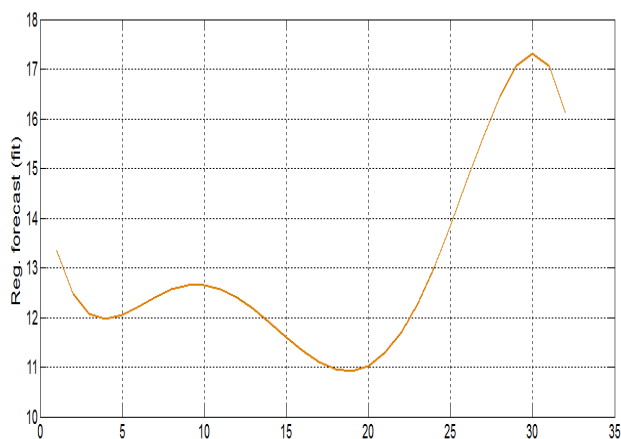


Figure (4) : The Changes Of Regressed Forecast Data Using SAS Package

Table (1) illustrates some of these results based on different ARIMA models using Different packages. Different ANFIS models with different number of inputs (previous days data) were investigated. Also, the effect of shape of membership on wind speed forecasting are studied as well as different numbers Of Membership Functions. The comparison of these ANFIS techniques are illustrated in Table (2). Table (3) illustrates The Comparison **Between Different** Between The Best Time Series Method And The Best ANFIS Method. The used techniques show promising results. However, they are competitive techniques.

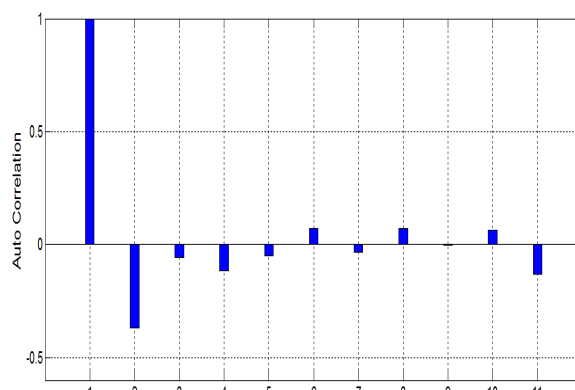


Figure (5) : The Auto Correlation Of The Data Using SAS Package

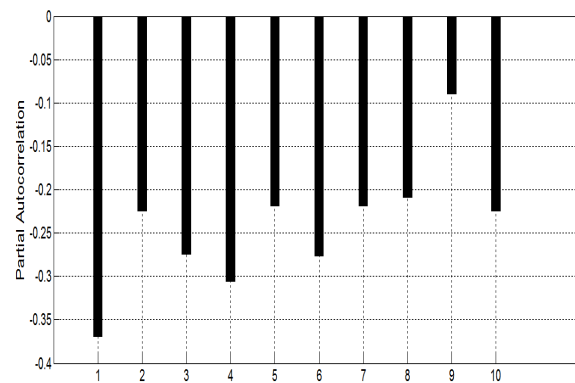


Figure (6) : The Partial Autocorrelation Of The Data

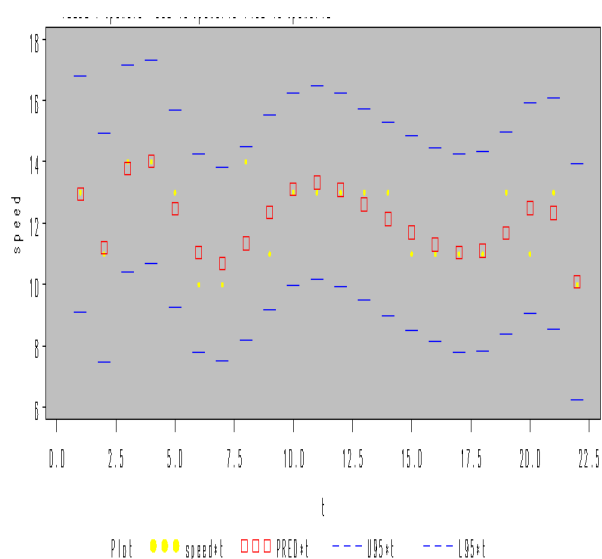


Figure (7) : The Changes Of Predict ,Lower And Upper Limit

**Table (1) : The Comparison Time Series Methods (SAS And Matlab Packages)**

Date	Original Data	When Matlab Programs used		When SAS Package Used		Error	When Matlab Programs Used		When SAS Package Used	
		ARIMA (1,0,1)	ARIMA (1,1,1)	ARIMA (1,0,1)	ARIMA (1,1,1)		ARIMA (1,0,1)	ARIMA (1,1,1)	ARIMA (1,0,1)	ARIMA (1,1,1)
23/9/2010	11	10.2423	10.6432	10.7505	10.72		6.9%	3.24%	2.268%	2.5%
24/10/2010	14	10.1724	11.0936	14.3397	14.32		27.34%	20.76	2.42%	2.2%
25/10/2010	16	15.1786	12.3433	16.62819	16.7		5.13%	22.85	3.926%	4.37%

**Table (2) : The Comparison Between Different Types Of ANFIS Techniques**

No Of Membership Function	2			3		4	Original Reading	% Error	2			3		4
	Four	Five	Six	Four	Five	Four			Four	Five	Six	Four	Five	Four
Tuesday	11.59	11.8	12	11.859	10.514	11.2	11		5.3	7.3	9.1	7.8	4.4	1.8
Friday	12.456	11.3	12.23	12.456	12.56	13.65	14		11	19.2	12.6	11	10.2	2.5
Saturday	12.34	12	11.1	11.828	16.7	13.5	16		22.8	25	30.6	26	4.37	15.6

**Table (3) : The Comparison Between The Best Time Series Method And The Best Anfis Method**

Date	Original Data	Reg. Forecast	RegARIMA Forecast	ANFIS	Error	
					ANFIS	RegARIMA Forecast
23/9/2010	11	10.784	10.7505	11.2	1.8%	2.268%
24/10/2010	14	14.377	14.3397	13.65	2.5%	2.42%
25/10/2010	16	16.66919	16.62819	13.5	15.6%	3.926%

## 5. CONCLUSION

The proposed research discussed the use of stochastic modelling as well as ANFIS in wind speed forecasting. ANFIS can forecast very good of the next value (short term forecasting) and time series can forecast of data near of the original data in short term. However, time series can forecast of medium and long forecasting better than ANFIS and by more efficiency. The illustrated results show the effectiveness of both methods in STF for wind speed. These methods will help in utilizing the renewable energy in an efficient way.

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4/5/2011

**Stochastic Modelling Compared With Artificial Intelligence Based Approach For Electrical Load Forecasting**A. Seif E. M. Gabr<sup>1</sup>, M. A. Moustafa Hassan<sup>2\*</sup>, O. Y. Abul-Haggag<sup>2</sup><sup>1</sup> North Cairo for Electrical Distribution Company (NCED), Ministry of Electricity, Egypt<sup>2</sup> Electrical Power Department, Faculty of Engineering, Cairo University, Giza, Egypt\*Corresponding e-mail: [mmustafa\\_98@hotmail.com](mailto:mmustafa_98@hotmail.com)

**Abstract:** Accurate load forecasting is very important for electric utilities in planning for new plants. Also it is very significant for the routine of maintaining, scheduling daily, electrical generation, and loads. In this study, emphasis was considered on short-term load forecasting which is important for real time operation and control of power systems. Artificial intelligence and stochastic forecasting models were examined. The performance of these models is dependent on the characteristics of electric loads and is based on the assumption that electric load patterns are basically invariant with time. Two different models were considered and a new stochastic model (called REGARIMA) was introduced and compared with ANFIS model. Both models were tested and shown to be the best one that represents the available data. The results obtained using the two approaches are very accurate and mutually competitive. Furthermore, they are very promising in short term forecasting techniques, which could be applied as well on wind speed forecasting.

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**Keywords:** Artificial Intelligence Techniques, Short Term Forecasting, Peak Loads, Stochastic Forecasting Models, ARIMA Models, Adaptive Neuro Fuzzy Inference Systems (ANFIS).

**1. Introduction**

Electrical load forecasting plays a central role in the operation and planning of power systems. The country wide energy estimation, the planning of new plants, the routine maintaining and scheduling of daily electric generation are dependent on accurate load forecasting. In this research Short Term Load Forecasting (STLF) will be considered. One of the most important benefits of the STLF is reliability for the power system i.e. to make these investments reliable via optimal accurate load forecasting. Short-term load forecasting is a very important task for electric utilities in order to manage the production, transmission, and distribution as well as generation of electricity in a more efficient and secure way. As an example of the importance of accurate forecasts, it was estimated that an increase of only 1% in the forecast error (in 1984) caused an increase of 10 million pounds in operating costs per year for one electric utility in the United Kingdom [1]. The first step in load forecasting is to collect the historical data of the system to be studied. This data could be the daily peak load (according to the type of forecasting to be operated), and always construct a time series  $y_t$ . Where  $y_t$  is the electric load as a function of time. There are many factors that affect the electric load demand like time variation, gross national product, population, and climatic changes. And the more we are precise in determining their effect on load

demand the more accurate forecasting we get. The main mission for a forecaster is to study the behaviour of the collected historical data (which is called data mining), and determining the different patterns of the time series [2].

This work studies the applicability of two different models on short-term load forecasting. The approach is comparative. The models are: Time Series model and Artificial Intelligent model to forecasting the daily peak load. Testing is carried out on the real load data of a North Cairo electric utility. The objective is to accomplish suggestions on choosing the most appropriate model(s).

As there is need to forecast the load accurately, another goal is to study the performance of the models for different lead-times. Naturally, it seems possible that different models should be preferred for the short-term forecasting range. There are some properties, which are considered important:

- The model should be automatic and able to adapt quickly to changes in the load behaviour.
- The model is intended for use in many different cases. This means that generality is desired.
- Updating the forecast with new available data should be possible. The hours closest to the forecasting time should always be forecast as accurately as possible.



- The model should be reliable. Even exceptional circumstances must not give rise to unreasonable forecasts.
- The model should be easily attachable to an energy management system.

The proposed work does not study the forecasting for special days, such as religious and legal holidays. Special days have different consumption profiles from ordinary days, which make forecasting very difficult for them. Choosing a forecasting technique to be used in establishing future load requirements is a nontrivial task in itself. Depending on the nature of load variations, one particular method may be superior to another. Before choosing a particular method, whether it be simple curve fitting or stochastic modelling, a basic understanding of how a load behaves is essential. If, on the basis of historical data and good judgment, simple extrapolation appears to suffice, it should be used, unfortunately. This is due to all electric utilities are somewhat different. It is impossible to list all system attributes that may be adequately modelled by a particular technique. Choosing the best technique for a given utility, once again, requires good judgment and knowledge of the advantages and disadvantages of various available methods. Once a method has been chosen, the forecaster must always re-evaluate its effectiveness, because forecasting techniques can survive their usefulness, as a result of either drastic changes in a system or improvements in available methods [3].

A wide variety of models, varying in the complexity of functional form and estimation procedures, has been proposed for the improvement of load forecasting accuracy. Load forecasting techniques are classified into some categories. These categories of load forecasting techniques are [35]:

- Multiple regression [4, 7-9];
- Iterative reweighed least-squares [10];
- Adaptive load forecasting [11];
- Stochastic Modelling [12-17];
- Neural Networks [23-26];
- Fuzzy Logic [29]; and
- Neuro Fuzzy systems [32-34].

A large variety of mathematical methods and ideas have been used for load forecasting. The development and improvements of appropriate mathematical tools will lead to the development of more accurate load forecasting techniques. These categories of load forecasting techniques were discussed in [35].

The widely statistical measures of error that can help to identify method or the optimum value of the parameter within a method are:

#### i) Mean Absolute Error (MAE):

The mean absolute error Value is the average absolute error value. Closer this value is to zero the better is the forecast.

#### ii) Mean Squared Error (MSE):

Mean squared error is computed as the sum (or average) of the squared error values. This is the most commonly used lack-of-fit indicator in statistical fitting procedures. As compared to the mean absolute error value, this measure is very sensitive to any outlier; that is unique or rare large error values will impact greatly MSE value.

#### iii) Root Mean Squared Error (RMSE):

It displays the root mean square error for each model selected.

### 2. Characteristics of Peak Load Data:

Daily Peak Loads are used for short term load forecasting (STLF), and the notable features of this data type are:

- a) The available data are the daily peak load in MW from north Cairo of Electricity Distribution Company for the years 2008 and 2009.
- b) The original data takes the shape illustrated in Figure 1.

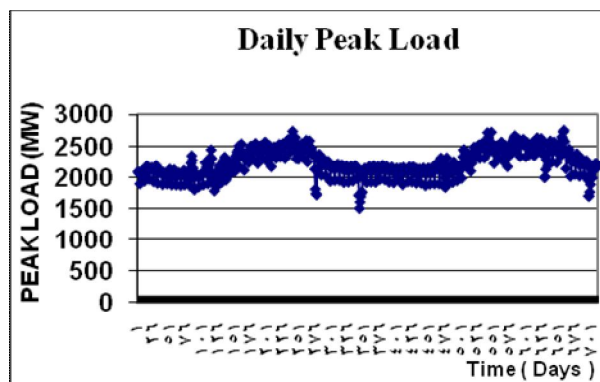


Figure 1: Daily Peak Loads of the North Cairo UN

### 3. Results of Tested Models:

Time series analysis and forecasting is an active research area over the last few decades. The accuracy of time series forecasting is fundamental to many decision processes and hence the research for improving the effectiveness of forecasting models has never stopped. With the efforts of Box and Jenkins [12], The ARIMA model has become one of the most popular methods in the forecasting research and practice. More recently, artificial neural networks have shown their promise in time series forecasting applications with their nonlinear

modelling capability. Although both REGRESSION and ARIMA have the flexibility in modelling a variety of problems, none of them is the universal best model that can be used indiscriminately in every forecasting situation. The combination method can be an effective way to improve forecasting performance.

Different models were tested and investigated in this study. Among these models : two stochastic models were considered then compared to some ANFIS Models. The results will be illustrated and discussed as follow:

#### A) The Time Series Results:

In this study, a combined approach (Regression and ARIMA models) is implemented via the SAS software package [36]. The R-square value (Rsqr), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and Mean Percentage Error (MPE) are selected to be the forecasting accuracy measures.

#### B) Multiple Regression Model:

The Multiple Regression method is applied on the historical data of the electric load consumption for 716 data points representing daily peak load for the years 2008 and 2009 in North Cairo. The SAS program is used to forecast the electrical load. Two Multiple Regression models are used:

- Multiple Regression for (t power 5);
- Multiple Regressions for (t power 12).

The resulting forecasts from the multiple regression model (REG<sup>5</sup>) are shown in Figure 2. Also, the upper and lower 95% confidence limits of the forecasts are plotted. The estimated model parameters are given on the graph of Figure 2.

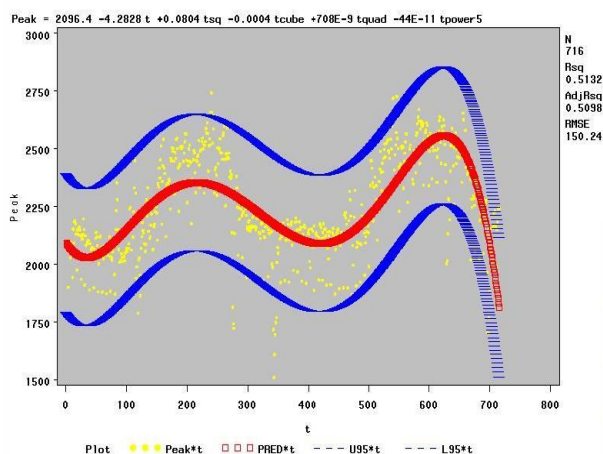


Figure 2 : Prediction of the Regression Model ( $t^5$ )

So the resulting equation of the 5<sup>th</sup> order Regression model is:

$$P_{REG^5} = 2096.42422 - 4.28275t + 0.08043tsq - 0.00038745tcube + 7.07553E-7 tqquad - 4.3677 E-10 tpower5 \quad (1)$$

Where:

$P_{REG^5}$  The predicted load for Regression model “t power 5”, and  
t is the time.

The residuals (or the errors) represent the difference between the original values of the load and the predicted values, based on the multiple regression model (REG<sup>5</sup>), are shown in Figure 3. It should be noted that those errors are completely random and have a near-zero mean.

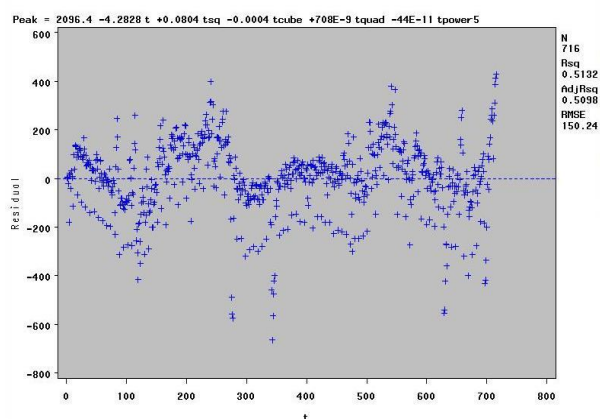


Figure 3 : Residuals of the Regression Model ( $t^5$ )

While the resulting forecast from the multiple regression model (REG<sup>12</sup>) are shown in Figure 4. Also, the upper and lower 95% confidence limits of the forecasts are plotted. A Regression model of order 12 has been found to be the most accurate among all Regression models that were also found adequate as judged by the residual analysis.

After building the Regression model for (t power 12). It is found that the coefficient estimates of the model are shown on the graph illustrated in Figure 4.

So the resulting equation of the Regression model is:

$$P_{REG^{12}} = 1969.20847 + 17.18128 t - 0.60363 tsq + 0.00807 tcube - 0.00005172 tqquad + 1.815585E-7 tpower5 - 3.6612E-10 tpower6 + 4.10676E-13 tpower7 - 2.1072E-16 tpower8 + 2.80029E-23 tpower10 - 2.203325E-30 tpower12 \quad (2)$$

Where:

$P_{REG^{12}}$  the predicted load for Regression model “t power 12”, and  
t is the time.

Also, the residuals or the error represent the difference between the original values of the load and the predicted values, based on the Regression model for (t power 12), are shown in Figure 5.

Hence, as the root mean square of the residuals decreases the model will be more accurate.

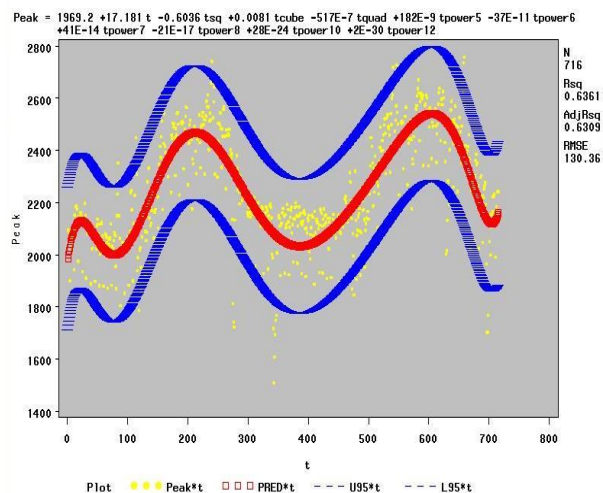


Figure 4 : Prediction of the Regression Model ( $t^{12}$ )

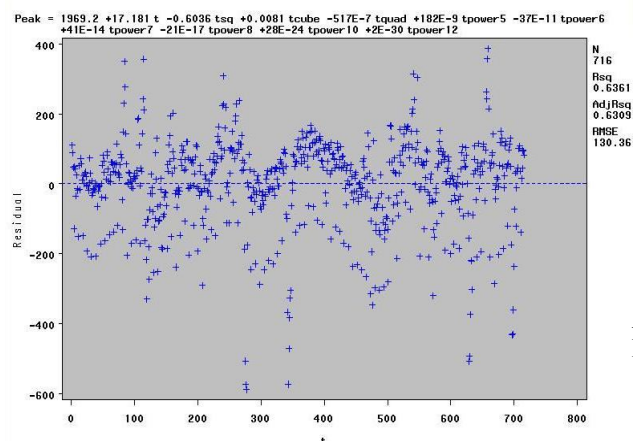


Figure 5 : Residuals of the Regression Model ( $t^{12}$ )

- The following descriptive statistics in Table (1) can distinguish the two models, showing Rsq, and RMSE.
- Different models, other than  $P_{REG}^5$  and  $P_{REG}^{12}$ , were also tested. The best results are obtained with the  $P_{REG}^{12}$  model.

Table (1) : Regression Models Statistics

Model	Rsq	RMSE
$P_{REG}^5$	0.5132	150.24
$P_{REG}^{12}$	0.6361	130.36

From the above results, it is cleared that, the RMSE of  $P_{REG}^{12}$  model is Less than the RMSE of  $P_{REG}^5$  model. On the contrary, the Rsq coefficient for  $P_{REG}^{12}$  model is greater than the Rsq coefficient for  $P_{REG}^5$  model. Thus, the  $P_{REG}^{12}$  model is more accurate.

### C) ARIMA Model:

In this model, the residuals of the fitted Regression model ( $P_{RESID}$ ) were taken as the input data used for building the ARIMA model. Now, two models of ARIMA were built to get the best and accurate model forecast using SAS Package.

#### i) ARIMA model (1, 0, 1):

In this Model the coefficients are identified as:  $p=1$ ,  $d=0$ , and  $q=1$ . Figure 6 presents the Autocorrelations of ARIMA (1, 0, 1) Model.

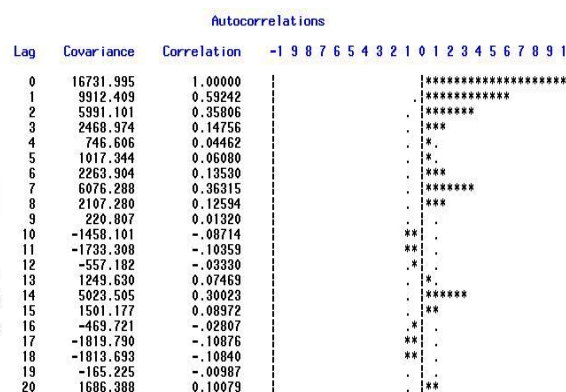


Figure 6 : Autocorrelations of ARIMA (1, 0, 1) Model

And the partial Autocorrelation of the ARIMA (1,0,1) Model as shown in Figures (5-7).

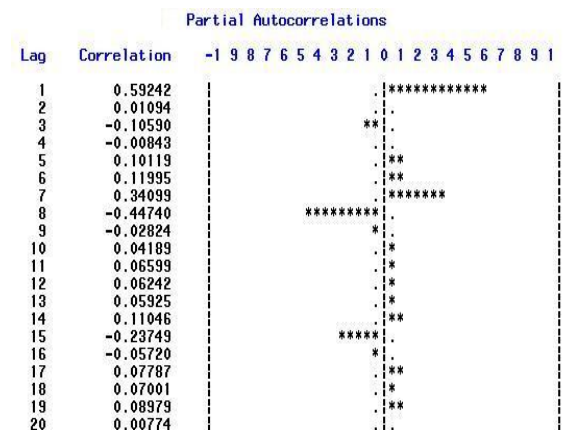


Figure 7 : Partial Autocorrelations of ARIMA (1, 0, 1) Model

The comparison of Figures 6, and 7 suggests that a differencing of degree 1 should be applied to the  $P_{RESID}$  data. Table (2) illustrates the electrical load forecasting of a combined REG<sup>12</sup> and ARIMA (1, 0, 1) models. The error presenting the difference between the original values of the load and the forecasted values, and the percentage error are given in Table (2). Hence, The Maximum Absolute Percentage Error is 8.11, which implies that the ARIMA (1, 0, 1) model has poor turning point forecasting ability.

## ii) ARIMA model (0, 1, 1):

In this Model the coefficients are  $p=0$ ,  $d=1$ , and  $q=1$ . The Autocorrelations of the first differences of  $P_{RESID}$  are illustrated in Figure 8, and the partial Autocorrelation of the first differences of  $P_{RESID}$  are shown in Figure 9.

Table (2) : Combined REG<sup>12</sup> and ARIMA (1, 0, 1) Models

Obs.	REG	ARIMA (1,0,1)	FORECAST	Measured	% Abs. Error
706	2,121.00	21.19	2,142.19	2,166.00	1.10
707	2,121.00	27.31	2,148.31	2,223.00	3.36
708	2,123.00	60.41	2,183.41	2,225.00	1.87
709	2,125.00	61.21	2,186.21	2,233.00	2.10
710	2,128.00	64.71	2,192.71	2,164.00	1.33
711	2,131.00	22.60	2,153.60	1,992.00	8.11
712	2,135.00	-81.10	2,053.90	2,151.00	4.51
713	2,140.00	8.51	2,148.51	2,184.00	1.62
714	2,146.00	26.29	2,172.29	2,241.00	3.07
715	2,152.00	56.72	2,208.72	2,245.00	1.62
716	2,159.00	55.69	2,214.69	2,242.00	1.22

Table (3) illustrates the electrical load forecasting of the combined REG<sup>12</sup> and ARIMA (0, 1, 1) model. This model will be called (REGARIMA), since it is based on combination of Regression model as well as ARIMA. The error represents the difference between the original values of the load and the forecasted values; and, it indicates as seen in Table (3), The Maximum Absolute Percentage Error is 2.98 %. So it indicates that the accuracy of ARIMA (0, 1, 1) is better than the previous model.

## iii) Choice of the Best Stochastic Model:

Table (4) shows that the ARIMA (0, 1, 1) model has the lower Root Mean Square Error (RMSE), lower Mean Absolute Error (MAE), and lower Mean Percentage

Error (MPE), thus it is the best and accurate model for these data.

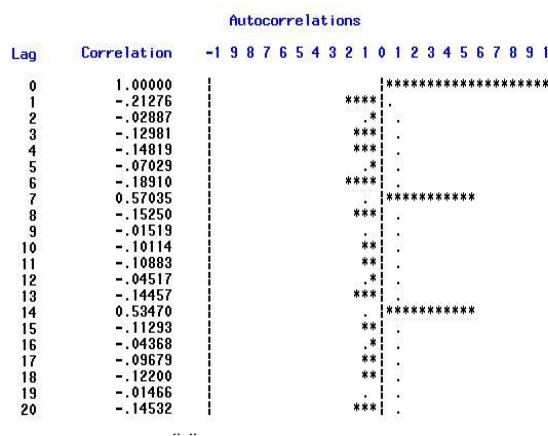


Figure 8 : Autocorrelations of ARIMA (0, 1, 1) Model

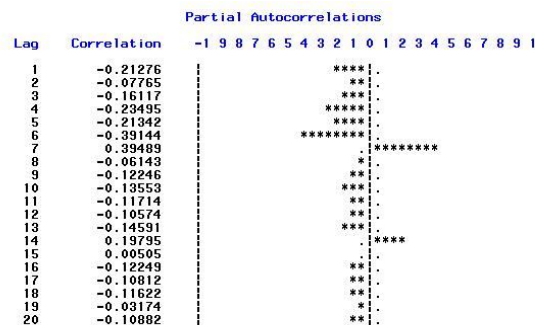


Figure 9 : Partial Autocorrelations of ARIMA (0, 1, 1) Model

Table (3) : Combined REG<sup>12</sup> and ARIMA (0, 1, 1) Models

Obs.	REG	ARIMA (0,1,1)	FORECAST REGARIMA	Measured	% Abs. Error
706	2,121.00	14.11	2,135.11	2,166.00	1.43
707	2,121.00	35.93	2,156.93	2,223.00	2.97
708	2,123.00	81.67	2,204.67	2,225.00	0.91
709	2,125.00	95.94	2,220.94	2,233.00	0.54
710	2,128.00	104.41	2,185.02	2,164.00	0.97
711	2,131.00	57.02	2,051.44	1,992.00	2.98
712	2,135.00	-79.56	2,121.92	2,151.00	1.35
713	2,140.00	-13.08	2,166.69	2,184.00	0.79
714	2,146.00	26.69	2,220.52	2,241.00	0.91
715	2,152.00	74.52	2,239.29	2,245.00	0.25
716	2,159.00	87.29	2,246.29	2,242.00	0.19



Table (4) : The Comparison of Two Different Stochastic Models

Model	RMSE	MAE	MPE
ARIMA (1, 0, 1)	70.37	23.77	1.00
ARIMA (0, 1, 1)	32.29	10.65	0.46

**D) ANFIS Model:**

The ANFIS Model is applied on the historical data of the electric load consumption. Four different ANFIS Models were tested (using MATLAB and Simulink package [30]) to predict the best and accurate model. The inputs of the ANFIS system are considered the data of previous day to the forecasted day (Its Peak load).

## i) Training data for ANFIS Model:

The training data used to train the ANFIS of the electrical load consumption are taken from 705 data point represents actual values of daily peak load for the years of 2008 and 2009 in North Cairo. It is the same data as used before.

## ii) The ANFIS predictor:

The ANFIS predictor consists of Number of neurons in the input layer, three triangular Membership Functions (MF) for each input i.e.  $M=3$  and constant membership function for the output. These types of MFs are chosen because they offer the best performance among other types of the MFs.

## iii) Testing data for Model:

The used data were tested on the obtained ANFIS Model. After testing data the estimated values show promising models. So, the estimated values from the simulation model will be compared with the actual values to obtain the absolute error and the percentage error. However, these procedure will be repeated for four different ANFIS model ( where the number of inputs are different in each case).

## iv) Choice of The Best ANFIS Model:

The forecasted loads which obtained from the four Models of ANFIS demonstrate a good performance for ANFIS Model (2) which depends on (4 previous readings) as shown in Table (5). The choice of the best ANFIS Model depends on many coefficients such as Root Mean Square Error (RMSE), Mean Absolute Error (MAE) and Mean Percentage Error (MPE). They are shown in Table (6), which shows that the best and

accurate model is ANFIS Model (2) which has the latest RMSE, MAE and MPE, so it is a very accurate model.

Table (5) : Comparison of Estimated Values of ANFIS Models

Measured	FORECAST			
	ANFIS Model (1)	ANFIS Model (2)	ANFIS Model (3)	ANFIS Model (4)
2166	2146	2167	2173	2128
2223	2155	2155	2115	2126
2225	2254	2212	2165	2190
2233	2160	2172	2172	2187
2164	2181	2180	2176	2197
1992	2012	2042	2079	2129
2151	2031	2076	2093	2056
2184	2127	2126	2129	2157
2241	2224	2211	2197	2149
2245	2227	2241	2194	2203
2242	2253	2201	2196	2216

Table (6) : Comparison of The Coefficients of ANFIS Models

Model	ANFIS Model (1)	ANFIS Model (2)	ANFIS Model (3)	ANFIS Model (4)
RMSE	52.45	45.58	57.58	70.52
MAE	30.09	25.73	28.73	28.09
MPE	1.22	1.15	1.50	1.29

## v) Fitting for Observations Used in Training:

The fitting of the data using the two proposed techniques for observations previously used in training is presented in Table (7). It is clear that, The ANFIS Model is more closely to the measured values than the Combined Model (REGARIMA).

In Table (8) The RMSE, and MAE of the ANFIS Model is lower than the Combined Model. However, The MPE in Two techniques is the same. So, The ANFIS Model is more accurate than the Combined REGARIMA Model.

E) Comparisons of The Two Approaches  
(Based on New Observations):

The comparison of the two forecasted electric load techniques are demonstrated in Table (9) with the actual "Measured" values.



Table (7) : Fitting Results for Observations Previously Used in Training

Obs	Measured	FORECAST		Abs. Percentage Error	
		ANFIS Model (2)	REG ARIMA (0,1,1)	ANFIS Model (2)	REG ARIMA (0,1,1)
183	2,546	2,494	2,520	0.02	0.01
222	2,492	2,379	2,371	0.05	0.05
366	2,175	2,174	2,168	0.00	0.00
549	2,502	2,535	2,589	0.01	0.03

It indicates that, the obtained forecasted values are close to the actual values. However, the forecasting results of the combined model (REGARIMA) are superior to the results of The ANFIS model. Furthermore, these observations are not used in training.

Table (8) : Comparison Between The Used Techniques

Model	RMSE	MAE	MPE
REGARIMA(0,1,1)	75.72	33.25	0.01
ANFIS Model (2)	64.35	16.75	0.01

Table (9) : Forecasting Results of The Two Approaches

Obs	Measured	FORECAST		Abs. Percentage Error	
		ANFIS Model (2)	REG ARIMA (0,1,1)	ANFIS Model (2)	REG ARIMA (0,1,1)
706	2,166.00	2,167.00	2,135.11	0.05	1.43
707	2,223.00	2,155.00	2,156.93	3.06	3.07
708	2,225.00	2,212.00	2,204.67	0.58	0.92
709	2,233.00	2,172.00	2,220.94	2.73	0.56
710	2,164.00	2,180.00	2,185.02	0.74	0.96
711	1,992.00	2,042.00	2,051.44	2.51	2.91
712	2,151.00	2,076.00	2,121.92	3.49	1.40
713	2,184.00	2,126.00	2,166.69	2.66	0.81
714	2,241.00	2,211.00	2,220.52	1.34	0.93
715	2,245.00	2,241.00	2,239.29	0.18	0.25
716	2,242.00	2,201.00	2,246.29	1.83	0.20

Table (10) shows The RMSE, MAE, and MPE. These indices are all the lowest for The REGARIMA model. The results obtained in the two approaches are very encouraging. Moreover, the maximum percentage error is less than 3.49% for both models which is very acceptable.

#### 4. Conclusions:

The proposed hybrid model (REGARIMA) that combines the regression model, and ARIMA model technique proves to be slightly more efficient than the ANFIS Model for Short –Term Load Forecasting purposes. This stems from the fact that the ARIMA model is devoted solely to investigation of the random effects in the Peak Load Data. The proposed hybrid model was compared to different ANFIS models. Both techniques are promising for Short –Term Load Forecasting purposes. These ptposed techniques could be used in forecasting of wind speed as well.

Table (10): Comparison Between The Used Techniques

Model	RMSE	MAE	MPE
REGARIMA(0,1,1)	32.29	10.65	0.46
ANFIS Model (2)	45.58	25.73	1.15

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4/5/2011

**Distance Education: definitions and applications**

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**Abstract:** Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-instructor relationship, which is the hallmark of distance education instruction.

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**Keywords:** Distance Education, E-learning

**Introduction:**

The background of distance education to mid-nineteenth century dates. Pioneers in America and Europe of the best distance learning technologies for training that day, took advantage. For example: mailing system for creating educational opportunities for those able to go to regular schools were not interested in science education, but had been used. Of course at that time most of those who took advantage of this type of Physically Handicapped facilities, women allowed to attend the classes along with men who did not have a. Location is N. There was a school; were. One of the pioneers in this field English personal name was Isaac Pitman. His short-term training through correspondence and the correspondence began in 1840 in England. Students were required to read the Bible a part of written questions and answers raised by Pittman to get a good score should return by mail.

But distance education in America and for the first time at the University of Illinois Veslin was implemented in 1874. In 1900, university education through correspondence, face became more public. National Association of Home Education in 1926 and led the establishment of distance education and related programs in universities and schools, and more important aspect to find drivers. Education in 1920 invented the radio and TV appearance in 1940 led to important new techniques in communications

that the nature of the field of distance education also created dramatic changes.

Trainers using these new technologies were successful educational programs to millions seek learning opportunities and thereby reach out to the educational spaces, training centers to expand. With the development of long-distance telephone system in the early twentieth century method of capacity and distance learning methods for students to access educational opportunities in the world increased Translation. But until the invention of mobile tele conference ever in the 80 and 90 and the main role in the concept of distance education did not play. Telemetry system, allowing for teachers conference provided that without the slightest delay at a time when your students can listen to them talk and sometimes they see.

Expansion of computer networks in the decade 1990 and connect millions of people through lines to the telephone networks made it possible to simply distance learning via computers and computer conferences around the world is possible (a) and Today with the development of control technology in science and technology around the world are.

**What is Distance Education?**

Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for

students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-instructor relationship, which is the hallmark of distance education instruction.

Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology. Courses are offered in gemology, high school diploma, journalism, locksmithing, child day care management, yacht design, and many fascinating subjects. Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study.

Since 1890, more than 130 million Americans have studied at DETC member institutions, including Franklin D. Roosevelt, Walter P. Chrysler, Walter Cronkite, Barry Goldwater, Charles Schulz, and many other distinguished alumni of DETC members. Unlike most distance education courses offered by traditional colleges and universities that are semester and classroom oriented, with courses offered by most of the DETC-accredited institutions you can study anytime and anywhere. Distance education is especially suited for busy people who wish to increase their knowledge and skills without giving up their jobs, leaving home, or losing income. You learn while you earn. Many courses provide complete vocational training; others prepare you for upgrading in your present job, without losing wages, experience or seniority. You receive individual attention, and you work at your own pace.

In recent years, technology has played a significant role in transforming the traditional distance education school into a dynamic, interactive distance learning method using toll-free telephone lines, as well as a diverse array of personal computers, video devices, CD and DVD ROMs, online courses over the Internet, interactive devices, and other modern technological innovations. The future for distance study promises to be exciting.

#### **Benefits of Distance Learning:**

Benefits and opportunities that distance education provides, include:

- training a wide range of audiences.
- meet the needs of students and students who can not attend in place.
- Possible connection between students and students with cultures, beliefs and experiences are different.
- Benefiting from coaches and speakers who do not live in the country.

#### **Educational methods in distance learning:**

Today, under the new system replaced the traditional systems of learning and learning week (ie tutoring methods, lectures) are:

##### **- Multimedia courses:**

These courses and widely used elements of image, communication, graphics and simulated components, animation and communication elements for guidance and tips, and talk back on course and curriculum issues are held.

##### **- Enhanced communication mechanisms:**

The mechanism of any texts simultaneously, and asynchronous audio-visual communications to protect you. This case allows students to practice on topics learned will give.

##### **- Written test:**

thus, question and test via a distributed communication network, are corrected and returned. These exams through video conferencing support and runs.

##### **- Virtual Seminar:**

thereby different groups of students in different geographical environments linked together makes.

##### **- Collaborative virtual laboratories:**

the laboratory of the Group's activities are supported. Workshops such as software engineering.

##### **-Smart academic factors:**

academic factors that inform intelligent, support and guidance students pay.

##### **Remote educational tool:**

distance learning tools and supplies various uses. These tools in four main courses are:

##### **A - Audio Tools:**

Audio tools include training such as two-way interactive telephone, video conference, shortwave

radio and a strain of tools such as audio tape and radio.

**B - Image tools:**

including slides, films, video tapes and video conferences.

**C - Data:**

computers as electronic data are sent and received. Because the data word description for a wide range of educational tools is used.

Computer applications for distance education are varied and include the following:

- 1- Training to Computer Management.
- 2 - Computer Assisted Instruction.
- 3 - through PCs.
- 4 - e-mail, telegraph, computer conference and the World Wide Web simultaneously.

**D - Print:**

The main element of distance education programs, particularly in the exchange and delivery system information tools are considered.

**Key factors in the process of distance education:**

the process of remote training, the following factors contribute:

**- Students:**

Regardless of educational content, role and main element in the learning process students are responsible.

**- Coaches and Teachers:**

Success depends on a lot of educational activities the ability, skills and knowledge are the coaches and professors.

**- Facilitators of communication:**

Facilitator bases, as the bridge between students and mentors are. Must base expectations of teachers and educational needs of students and service coordination and communication to create.

**- Support staff:**

One of the important pillars of any development of distance education programs, by development group finds. Operational support staff such as student registration, copy and distribute their resources, order textbooks, security and copyright, and are responsible for the report.

**- Management:**

The group decision makers, builders and judges are considered to be educational and should be considered among the factors above, establish the correct relationship formation.

## FORMS OF DISTANCE EDUCATION

In its original form, teachers using distance education traveled to remote sites and taught a class,

or corresponded with students through mail, telephone, or fax machine. Individualized study has been a method of reaching the remote student for some time. Detailed course instructions are sent to the learner who performs the assigned tasks and returns the completed work to the teacher for evaluation and reassignment if necessary.

Technology has raised the quality of individualized distance instruction. The use of various forms of electronic media increases time effectiveness and improves the delivery of information. Video, audio, and computer-based applications may enhance the product received by the independent learner. Electronic delivery can occur using synchronous communication, in which class members participate at the same time, or asynchronous communication where participants are separated by time (Romiszowski, 1993).

Video/audio models of distance education include broadcast television, cable television, satellite, microwave, fiber optics, and audio graphics. The most widely used format is broadcast and cable television (Parrott, 1995). However, developments in satellite and fiber optic systems have produced other successful programs. The interactive capability of many of these networks has produced a distance classroom that is nearly identical to a regular classroom. Teachers and students can interact through both two-way video and one-way video with two-way audio systems. The recent development of Desktop Video Conferencing (DVC) which brings interactive video capability to the desktop computer, further enhances learning opportunities.

The linking of computer technology through the use of the Internet or CD-ROM with television transmission provides a potentially new dimension to distance education. This technique can link university professors to high school teachers, or to physically disabled students, in a distance setting (McLean, 1996).

Another form of interaction is the use of computer conferencing. This method utilizes asynchronous communication in such forms as an e-mail list group, an Internet discussion group, or other types of conferencing software. Asynchronous methods of communication are especially appealing to the learner who has difficulty scheduling specific time- and place-bound course work.



**Have you been wondering about Distance Education?**

Distance Education implies the provision of educational services to students who are not physically present.

Put more simply, its educational courses, whether short-term programs granting a specific certification or complete academic degrees, which are delivered online or via other media, like TV and VCR, CDs, audio tapes, or mailed print material.

**What Distance Education is all about?**

The main aspects of Distance Education are as follows-

**1. Geography:** The point of Distance Education is to educate despite geographical differences. Online education effectively abolishes geographical as well as time differences, allowing an unprecedented number of students from all over the world to study in an institution, at any time of day.

**2. Why higher education and Why take it from Distance:** The world of today requires advanced education. Nowadays, advanced degrees are the standard – Having more than one education is not extraordinary but sometimes a must. Foreign studies are also common. With the increased penetration of the Internet, Distance Education, offering anything from individual classes to complete doctoral degrees online, is a natural development of modern educational processes and requirements.

**3. Distance Education as we know it today:** It is a web-based education developed using e-Learning software tools and other distance-communication means. With increasing reliance on information, the demand for better and faster education grew and brought about the Internet.

**4. Who Uses Distance Education?** More and more people acquire higher education. Even professionals with full-time careers acquire new degrees, without change of pace at work. Distance education is perfect for the Military and for social institutions of all kinds. Parents can now combine higher education with family. Foreign education has never been easier – all it takes now is to log on.

Distance Education reaches out to all those segments of population which only a decade or so ago were almost completely neglected by educational systems.

In the nearest future cultural, educational, corporate diversity will reach never-before-seen peaks.

Distance education is any type of schooling that takes place away from a physical campus. Distance education is also known as:

- distance learning
- virtual learning
- online learning
- e-learning
- online education
- web-based training

**Types of Distance Education Programs:**

There are two types of programs offered by distance education schools: synchronous learning programs and asynchronous learning programs. With synchronous learning, distance education students must log on to the school's website at a set time. Often, they interact with their peers and professors via group chats, web seminars, video conferencing, and phone call-ins. With asynchronous learning, distance education students complete all coursework on their own time. They often learn via assignment sheets, message boards, email, pre-recorded video lectures, mp3s, and traditional mail correspondence.

Distance education began for the delivery of courses to students who live in remote areas. Over the years, though, this form of education has become the preferred method for learning outside of the classroom.

Distance Education is now undertaken by people with busy schedules, hectic lifestyles, special needs, and also those living in isolated areas. What's more, with such flexible learning options you can choose to study at any time and from any location you like.

There are a number of different **forms of distance education** and it's important to know which method you prefer:

- **Correspondence learning:** your course materials are printed and sent out to you by mail/courier. The advantages are that you have a printed set of reference materials, you

can study anywhere and you are not reliant on a computer, you can learn for long periods of time.

- **eLearning:** your course materials are provided to you in multimedia format; that is, on CD/DVD. In this way you can choose to take your study materials within you and learn anywhere in the world with just a laptop.
- **Online learning:** no materials are sent to you and you do all your learning online. The limitation is that you need to be logged onto a computer (though you may be able to download and print some of your materials yourself, though this can cost you more in ink), there is a limit to how much you can absorb and do online, and most people's attention span on-screen is limited to 20 minutes (your eyes get tired after that).
- **Broadcast learning:** where you tune into a series of television, radio or Internet broadcasts (e.g. podcast, YouTube, etc.).
- **Teleconferencing:** where your lessons are conducted in real time through an Internet connection. Limitations are that streaming can be slow, connections can cause problems (students and teachers generally need to be computer literate) and there can be delays in talk-time, depending on software, hardware and connection capabilities.

### Conclusion:

Distance learning is expanding and examples of it are increasing dramatically. Fewer than 10 states were using distance learning in 1987; today, virtually all states have an interest or effort in distance education. Distance learning systems connect the teacher with the students when physical face-to-face interaction is not possible. Telecommunications systems carry instruction, moving information instead of people. The technology at distant locations are important and affect how interaction takes place, what information resources are used, and how effective the system is likely to be.

Technology transports information, not people. Distances between teachers and students are bridged with an array of familiar technology as well as new information age equipment. What sets today's distance education efforts apart from previous efforts is the possibility of an interactive capacity that provides learner and teacher with needed feedback,

including the opportunity to dialogue, clarify, or assess. Advances in digital compression technology may greatly expand the number of channels that can be sent over any transmission medium, doubling or even tripling channel capacity. Technologies for learning at a distance are also enlarging our definition of how students learn, where they learn, and who teaches them. No one technology is best for all situations and applications. Different technologies have different capabilities and limitations, and effective implementation will depend on matching technological capabilities to education needs.

Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home.

The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.

Interactivity is accomplished via telephone (one-way video and two-way audio), two-way video or graphics interactivity, two-way computer hookups, two-way audio. Interactivity may be delayed but interaction provided by teacher telephone office hours when students can call or through time with on-site facilitators. Classes with large numbers of students have a limited amount of interactivity. Much of the activity on computer networks is on a delayed basis as well. Possibilities for audio and visual interaction are increasingly wide.

In the earlier days of distance learning, it was most common to see distance learning used for rural students who were at a distance from an educational institution. The student might watch a telecourse on a

television stations, read texts, mail in assignments and then travel to the local college to take an exam. This model is still in use, but as the technology has become more sophisticated and the cost of distance learning dropped as equipment prices dropped, the use of distance education has increased.

High front-end costs prevented an early widespread adoption of electronically mediated learning. Distance learning has been aggressively adopted in many areas because it can meet specific educational needs. As the concept of accountability became accepted and laws required certain courses in high school in order for students to be admitted to state colleges, telecommunications was examined as a way to provide student access to the required courses. Many rural school districts could not afford the special teachers to conduct required courses. Distance education met this need by providing courses in schools where teachers were not available or were too costly to provide for a few students. It also fulfilled a need for teacher training and staff development in locations where experts and resources were difficult to obtain. These systems link learner communities with each other and bring a wide array of experts and information to the classroom.

Challenges which faced the early users of distance education are still with us today. If distance education is to play a greater role in improving the quality of education, it will require expanded technology; more linkages between schools, higher education, and the private sector; and more teachers who use technology well. Teachers must be involved in planning the systems, trained to use the tools they provide, and given the flexibility to revise their teaching. Federal and state regulations will need revision to ensure a more flexible and effective use of technology. Connections have been established across geographic, instructional, and institutional boundaries which provide opportunities for collaboration and resource sharing among many groups. In the pooling of students and teachers, distance learning reconfigures the classroom which no longer is bounded by the physical space of the school, district, state or nation.

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**Assessing Similarities and differences between Distance Education and e-learning**

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**Abstract:** Distance education can be used for some aspects of most disciplines. For example, several institutions of higher education already have developed certificate programs, undergraduate programs, and graduate programs in health and physical education that are delivered using distance education methods. Eastern Oregon University, Emporia State University, Kutztown University, LaSalle University, the Medical College of Wisconsin, University of Wisconsin at Stevens Point, and Virginia Tech are among institutions integrating distance technology into their physical education programs. Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media.

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**Keywords:** Distance Education, E-learning

**Introduction:**

Distance education in America and for the first time at the University of Illinois Veslin was implemented in 1874. In 1900, university education through correspondence, face became more public. National Association of Home Education in 1926 and led the establishment of distance education and related programs in universities and schools, and more important aspect to find drivers. Education in 1920 invented the radio and TV appearance in 1940 led to important new techniques in communications that the nature of the field of distance education also created dramatic changes.

Trainers using these new technologies were successful educational programs to millions seek learning opportunities and thereby reach out to the educational spaces, training centers to expand. With the development of long-distance telephone system in the early twentieth century method of capacity and distance learning methods for students to access educational opportunities in the world increased Translation. But until the invention of mobile teleconference ever in the 80 and 90 and the main role in the concept of distance education did not play. Telemetry system, allowing for teachers conference provided that without the slightest delay at a time when your students can listen to them talk and sometimes they see.

Expansion of computer networks in the decade 1990 and connect millions of people through lines to the telephone networks made it possible to simply distance learning via computers and computer conferences around the world is possible (a) and

Today with the development of control technology in science and technology around the world are.

Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-instructor relationship, which is the hallmark of distance education instruction.

Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology.



Courses are offered in gemology, high school diploma, journalism, locksmithing, child day care management, yacht design, and many fascinating subjects. Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study.

Since 1890, more than 130 million Americans have studied at DETC member institutions, including Franklin D. Roosevelt, Walter P. Chrysler, Walter Cronkite, Barry Goldwater, Charles Schulz, and many other distinguished alumni of DETC members. Unlike most distance education courses offered by traditional colleges and universities that are semester and classroom oriented, with courses offered by most of the DETC-accredited institutions you can study any time and anywhere. Distance education is especially suited for busy people who wish to increase their knowledge and skills without giving up their jobs, leaving home, or losing income. You learn while you earn. Many courses provide complete vocational training; others prepare you for upgrading in your present job, without losing wages, experience or seniority. You receive individual attention, and you work at your own pace.

In recent years, technology has played a significant role in transforming the traditional distance education school into a dynamic, interactive distance learning method using toll-free telephone lines, as well as a diverse array of personal computers, video devices, CD and DVD ROMs, online courses over the Internet, interactive devices, and other modern technological innovations. The future for distance study promises to be exciting.

#### **Benefits of Distance Learning:**

Benefits and opportunities that distance education provides, include:

- training a wide range of audiences.
- meet the needs of students and students who can not attend in place.
- Possible connection between students and students with cultures, beliefs and experiences are different.
- Benefiting from coaches and speakers who do not live in the country.

#### **Educational methods in distance learning:**

Today, under the new system replaced the traditional systems of learning and learning week (ie tutoring methods, lectures) are:

- **Multimedia courses:**

These courses and widely used elements of image, communication, graphics and simulated components, animation and communication elements for guidance and tips, and talk back on course and curriculum issues are held.

- **Enhanced communication mechanisms:**

The mechanism of any texts simultaneously, and asynchronous audio-visual communications to protect you. This case allows students to practice on topics learned will give.

- **Written test:**

thus, question and test via a distributed communication network, are corrected and returned. These exams through video conferencing support and runs.

- **Virtual Seminar:**

thereby different groups of students in different geographical environments linked together makes.

- **Collaborative virtual laboratories:**

the laboratory of the Group's activities are supported. Workshops such as software engineering.

- **Smart academic factors:**

academic factors that inform intelligent, support and guidance students pay.

#### **Key factors in the process of distance education:**

the process of remote training, the following factors contribute:

- **Students:**

Regardless of educational content, role and main element in the learning process students are responsible.

- **Coaches and Teachers:**

Success depends on a lot of educational activities the ability, skills and knowledge are the coaches and professors.

- **Facilitators of communication:**

Facilitator bases, as the bridge between students and mentors are. Must base expectations of teachers and educational needs of students and service coordination and communication to create.

- **Support staff:**

One of the important pillars of any development of distance education programs, by development group finds. Operational support staff such as student registration, copy and distribute their resources, order textbooks, security and copyright, and are responsible for the report.

- **Management:**

The group decision makers, builders and judges are considered to be educational and should be considered among the factors above, establish the correct relationship formation.

## **FORMS OF DISTANCE EDUCATION**

In its original form, teachers using distance education traveled to remote sites and taught a class, or corresponded with students through mail, telephone, or fax machine. Individualized study has been a method of reaching the remote student for some time. Detailed course instructions are sent to the learner who performs the assigned tasks and returns the completed work to the teacher for evaluation and reassignment if necessary.

Technology has raised the quality of individualized distance instruction. The use of various forms of electronic media increases time effectiveness and improves the delivery of information. Video, audio, and computer-based applications may enhance the product received by the independent learner. Electronic delivery can occur using synchronous communication, in which class members participate at the same time, or asynchronous communication where participants are separated by time (Romiszowski, 1993).

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#### **Conclusion:**

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## Transmission Expansion Cost Allocation Based on Economic Benefit and Use of System

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**Abstract:** In the deregulation power system, it is necessary to develop an appropriate pricing scheme that can provide the useful economic information to market participants, such as generators, transmission companies and customers. However, accurately assessment and allocating the transmission cost in the transmission pricing scheme is a challenge, although many methods have been proposed. The objective of this paper is to introduce a simple transmission expansion pricing scheme using proportional tree and economic benefit method, to allocate and price the transmission expansion among the participants. Numerical example using a test power system is presented to illustrate the effectiveness of the studied method.

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**Keywords:** Transmission Expansion Cost Allocation, Economic Benefit, Use of System.

### 1. Introduction

The electric power market deregulation growth in many countries has allowed free competition. Markets have been deregulated and accordingly, generators, transmission, and distribution utilities should work as independent business units. Some markets have adopted locally marginal prices theory or transactions based on bilateral contracts. Open access to the transmission network is the key point that allows free competition in deregulated power markets. If there is open and nondiscriminatory access to transmission network, all generators are able to compete for supplying energy to any system customers.

In order to guarantee an open and nondiscriminatory access to the network, it is necessary to use methods that allow the network operator to recover its costs and to obtain an appropriate level of Benefit. On the other hand, payments should be fair and equitable for those participants who use the network. Network costs could be divided into two main components: one component that covers the operative costs and another component associated with transmission expansion.

Transmission expansion plays an important role in competitive power markets and in developing countries. In competitive markets, the expansion of the transmission system is necessary not only due to the growth of the demand but also due to geographical change of generation injection points. As there is competition, new generators can replace at the economic dispatch those generators that have

higher operative cost. These changes produce a redistribution of load flows in the network that may produce the capacity overloads of some network facilities, and in some cases, it could be necessary to expand the network [1].

Several allocation methods have been proposed for the network expansion costs [2]–[3]. They are essentially extensions of allocation methods for existing transmission network costs, such as the ones discussed in [4], [5], and [6]. Some allocate the costs according to the contribution of each user to the network flows. Other methods allocate the costs according to the economic benefit each user receives from the network expansion.

This paper presents a new method to allocate and price transmission expansion among the users based on economic benefit and use of the system. The transmission expansion cost is allocated to all the power network users based on their actual contribution to line flows. The proposed method is illustrated using IEEE 9 bus system.

### 2. Necessity of the Transmission Expansion

Power transmission expansion cost allocation becomes an important issue due to the deregulation of the electric power industry. In this paper, we assume that there is transmission congestion in a power system. The cost of transmission line expansion is shared among participants for the new line based on the economic Benefit and use of system.

If the congestion occurs in the transmission line, the output of the related Genco will be curtailed,

thereby reducing the profit of the Genco. However if the transmission line is expanded, the congestion will be relieved and the outputs of the Genco will increase as a result, which means that more electric power can be sold and more benefit of the Genco can be expected.

In the same way, if there is some congestion in the transmission lines, the electricity price purchased by the customers becomes expensive. However, when transmission line is expanded, the congestion will be relieved and the price becomes inexpensive so that customers can purchase more power from Gencos. Since all participants have Benefit due to the transmission expansion, the allocation expansion cost should be shared among them.

In some cases the cost allocation of the expansion transmission line between the participants are based to the economic benefit and in other cases based on the use of system. Each methodology has advantages and disadvantages that depend on their own features, the power system characteristics, and the price structure of the market. So the present a new method that overcome the disadvantages is essential.

### 3. Methodologies Based on Economic Benefit

This methodology to allocate transmission expansion costs is based on variations of economic Benefit that market users receive due to the network expansion. The economic benefit should be computed from the comparison of flows of money between the present system and the system with the expansion. Therefore, the method requires the simulation of the system operation during the study period with and without the new network facility.

The economic benefit (EB) obtained by a consumer  $d_i$  caused by the use of the new network facility is (terms indicated with apostrophe correspond to the system with the network expansion)

$$EB_{di} = d_i \rho_i' - d_i \rho_i \quad (1)$$

The expression of Benefit obtained by generators is similar, but the production costs  $C_{gi}$  should be decreased

$$EB_{gi} = g_i(\rho_i' - C_{gi}) - g_i(\rho_i - C_{gi}) \quad (2)$$

It should be noted that in (1) and (2), demand power  $d_i$  and generated power  $g_i$  are positive. To compute Benefit, negative benefit components should not be taken into account. There is no reason for allocating surplus pay for users that received additional revenue when the network capacity was not adapted. Finally, the expansion costs have to be paid by users proportionally to the benefit that they receive. This method results are attractive due to its economic basis and to the fact that it is appropriate to evaluate

facilities not connected in series such as parallel compensators. Although this method is simple from the conceptual point of view, its main disadvantage is the complexity in the calculation to determine Benefit. The benefit received by each market user caused by network expansions is extremely variable hour by hour.

### 4. Methodologies Based on Use of System

Various methods for allocation of transmission cost have been reported in the literature. The most common and simplest approach is the postage stamp method, which depends only on the amount of power moved and the duration of its use, irrespective of the supply and delivery points, distance of transmission use. Contract path method proposed for minimizing transmission charges does not reflect the actual flows through the transmission grid [7].

As another, MW-Mile methodology was introduced in which different users charged in proportion to their utilization of the grid [7-8]. The key feature in MW-Mile method is to find the contribution or share of each generator and each demand in each of the line flows. One of the significant methods reported for finding the share and contribution of generators and demands is flow based. J.Bialek has proposed a tracing method based on topological approach resulting in positive generation and load distribution factors [9].

D. Kirschen et al proposed a method to find the contributions of generators and loads by forming an acyclic state graph of the system making use of the concepts of domains, commons and links [10]. Other methods that use generation shift distribution factors are dependent on the selection of the slack bus and lead to eristic results.

This paper utilizes a new tracing algorithm, the proportional tree (PT) method to allocate and price transmission uses among the transmission participants based on proportional sharing principle that can be found in details in [11].

Essential data required for proportional tree tracing are the proportion of branch inflow in the node flow and the proportion of branch outflow in the node flow. The node flow is defined as either the total power flow entering a node or the total power flow leaving a node. The branch flow leaving a node is designated branch outflow and the branch flow entering a node is designated branch inflow in this paper.

The proportion of branch outflow for branch  $b$  and node  $n$  is represented by  $p_{b,n}^o$ . The proportion of branch inflow for branch  $b$  and node  $n$  is represented by  $p_{b,n}^i$ .

#### 4.1 Downstream Transmission Pricing

To calculate the price paid by generators, the transmission uses of generators are determined using downstream proportional tree tracing. In the downstream proportional tree tracing, the transmission loss of a transmission line is allocated to the sending bus of the line as the additional load of the bus.

##### 4.1.1 Generator Contribution Factors

The contribution factor from generator  $i$  to line  $j$  through path  $k$  ( $p_{gi,lj}^k$ ) can be calculated using the following equation:

$$p_{gi,lj}^k = \prod_{b \in Nb_k} p_{b,n}^o \quad (3)$$

where  $Nb_k$  is the set of branches in path  $k$ .

The total contribution factor from generator  $i$  to line  $j$  through all the related paths is:

$$p_{gi,lj}' = \sum_{k \in Np_{gi,lj}} p_{gi,lj}^k \quad (4)$$

where  $Np_{gi,lj}$  is the set of paths that connect generator  $i$  to line  $j$ .

##### 4.1.2 Generator Share in Line Flow

The share of generator  $i$  in the flow of line  $j$  can be calculated using the following equation:

$$s_{gi,lj} = \frac{p_{gi,lj}' \cdot p_{gi}}{\sum_{k=1}^{N_g} p_{gk,lj}' \cdot p_{gk}} \quad (5)$$

where  $N_g$  is the number of generator nodes and  $p_{gk}$  is the power output from generator  $k$ .

#### 4.2 Transmission Cost Allocation

The price paid by generator  $i$  for using transmission line  $j$  will be:

$$\rho_{gi,lj} = s_{gi,lj} \cdot x \cdot TC_j \quad (6)$$

where  $TC_j$  is total cost for line  $j$ . assume that a generator pays  $x$  percent and a load pays  $(1-x)$  percent of the total cost of a transmission line.

The price paid by generator  $i$  for using the transmission network will be:

$$\rho_{gi} = \sum_{j \in Ng_i} \rho_{gi,lj} \quad (7)$$

where  $Ng_i$  are the set of lines used by generator  $i$ .

#### 4.3 Upstream proportional trees

If loads pay the costs, the transmission uses are allocated to each load using upstream proportional tree tracing. In the upstream proportional tree tracing, the transmission loss of a

transmission line is allocated to the sending bus of the line as the extra negative generation of the bus.

##### 4.3.1 Load contribution factors

The contribution factor from load  $i$  to line  $j$  through path  $k$  ( $p_{di,lj}^k$ ) can be calculated using the following equation:

$$p_{di,lj}^k = \prod_{b \in Nb_k} p_{b,n}^i \quad (8)$$

Where  $Nb_k$  is the set of branches in path  $k$ .

The total contribution factor from load  $i$  to line  $j$  through all the related paths is:

$$p_{di,lj}' = \sum_{k \in Np_{di,lj}} p_{di,lj}^k \quad (9)$$

where  $Np_{di,lj}$  is the set of paths that connect generator  $i$  to line  $j$ .

##### 4.3.2 Load share in line flow

The share of load  $i$  in the flow of line  $j$  can be calculated using the following equation:

$$s_{di,lj} = \frac{p_{di,lj}' \cdot p_{di}}{\sum_{k=1}^{N_d} p_{dk,lj}' \cdot p_{dk}} \quad (10)$$

where  $N_d$  is the number of generator nodes and  $p_{dk}$  is the power output from generator  $k$ .

#### 4.4 Transmission cost allocation

The price paid by load  $i$  for using transmission line  $j$  will be:

$$\rho_{di,lj} = s_{di,lj} \cdot (1-x) \cdot TC_j \quad (11)$$

It is assumed that generators and customers in the market equally share the total transmission cost ( $x=0.50$ )

#### 5. Relation between Economic Benefit and Proportional Tree

The comparison of network cost allocation methods has been the aim of many studies in order to find their advantages and disadvantages. The proportional tree method measure the marginal use of the network, and the economic benefit method computes the benefit caused by the use of the network on the base of marginal prices. Thus both methods are depending.

In the case of combining both methods, it is necessary to simulate the test system in both present and expansion states. Then decision will be made proportional one of the following states.

A. Participant uses the expansion line and has economic benefit

B. Participant uses the expansion line and hasn't economic benefit

C. Participant doesn't use the expansion line and has economic benefit

D. Participant doesn't use the expansion line and hasn't economic benefit

Therefore we define the cost allocation expansion

$$\text{matrix: } CAEM = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$$

In the state D: the expansion cost is equal to zero ( $D=0$ )

In the state C: the expansion cost is calculated with the economic benefit method

In the state B: the expansion cost is calculated with the proportional tree method

In the state A: the expansion cost is calculated with the composition of two economic benefit and proportional tree method by the following relation:

$$\%x = \alpha.PT + (1-\alpha).EB \quad 0 \leq \alpha \leq 1 \quad (12)$$

Where  $\alpha$  is weight factor that depends on market structure and will be determined by ISO.

### 5.1 Transaction Pricing

If a bilateral transaction  $t$  utilizes a utility owned transmission network, the price paid by the transaction can be calculated using the following equation:

$$\rho(t) = \sum_{i \in N_d^t} \omega_{di}(t) \sum_{j \in N_{di}} \rho_{dilj} + \sum_{i \in N_g^t} \omega_{gi}(t) \sum_{j \in N_{gi}} \rho_{gilj} \quad (13)$$

where  $N_d^t$  and  $N_g^t$  are the set of load buses and the set of generator buses involved in the transaction, respectively,  $\omega_{di}(t)$  is the percentage of the transaction load in the total load at bus  $i$  and  $\omega_{gi}(t)$  is the percentage of transaction injection in the total generator injection at generator bus  $i$ .

### 6. Test Case

The IEEE 9 bus test system is analyzed to illustrate the proposed technique. The system contains 3 generating units and 9 transmission lines that shown in fig 1. The system configuration data can be found in [12]. All the generators are supposed to be marginal generators and for all transmission lines capacity are equal 150 MVA.

It is supposed that there are two bilateral transactions in the market. Let T1 representing the bilateral

transaction of 45 MW power between seller at G1 and customer at L5. The bilateral transaction of 50 MW power between seller at G3 and customer at L7 is represented as T2.

The flow of each transmission line from AC power flow solution can be calculated. Power flow is performed using MATPOWER software [12].

The locational marginal price of each bus should be assessment in order to calculate the congestion costs. Table 1 presents LMPs results based on the contributions of generators to line flows and the assumed generator marginal prices before and after expansion. After the expansion supposed that one line with the 150 MVA is parallel with the path 2-8 for congestion relief.

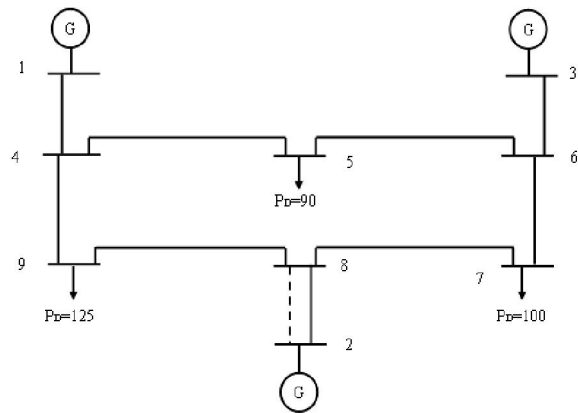


Figure 1. The single-line diagram of the IEEE 9 bus system

This case study illustrates that the proposed transmission pricing scheme can provide economic signals to each market participant about energy transactions. Table 2 shows the revenues of generation companies.

The transmission price for bilateral transaction can be calculated from its proportion in the node generation and demand. Table 3 shows the percentage of transmission costs that allocated to bilateral contracts T1 and T2.

The results obtained are compared with the three methods adopted to allocate the expansion cost allocation.

These are reflected in Tables 4 to 6 for the ( $\alpha = 0.4, 0.5, 0.6$ ) 9 bus system.

Table 1. Locational Marginal Price of each bus

Bus	LMP before expansion \$/MWh	LMP after expansion \$/MWh
1	27.000	27.000
2	21.388	26.133
3	26.384	26.335
4	27.000	27.000
5	27.305	27.287
6	26.384	26.335
7	26.491	26.438
8	26.196	26.133
9	27.262	27.249

Table 2. Revenues of Generation Companies

Generator	Before expansion				After expansion			
	Sale Price (\$/h)	Energy Sale (MWh)	Total cost (Fix, var & start up) (\$/h)	Earnings (\$/h)	Sale Price (\$/h)	Energy Sale (MWh)	Total cost (Fix, var & start up) (\$/h)	Earnings (\$/h)
1	27.000	93.41	1576.80	945.22	27.000	88.44	1452.59	935.30
2	21.388	149.89	2689.49	516.22	26.133	155.00	2828.13	1222.54
3	26.384	75	1099.06	879.72	26.335	75	1099.06	876.10

Table 3. Transmission Costs Allocation for Bilateral Transaction (%)

Line	From	To	T1		T2	
			Seller at G1	Buyer at L5	Seller at G3	Buyer at L7
1	1	4	15.276	10.71	0.0	0.0
2	4	5	10.71	10.71	0.0	0.0
3	5	6	0.0	4.36	4.36	0.0
4	3	6	0.0	4.36	16.666	12.276
5	6	7	0.0	0.0	12.276	12.276
6	7	8	4.483	0.0	0.0	4.483
7	8	2	0.0	0.0	0.0	0.0
8	8	9	4.493	0.0	0.0	4.493
9	9	4	4.52	0.0	0.0	4.52

Table 4. Transmission Expansion Cost allocations for the new line 2-8 that added the system with  $\alpha = 0.4$ 

	% $G_1$	% $G_2$	% $G_3$	% $D_5$	% $D_7$	% $D_9$
Proportional Tree	0	48.48	0	0	25.58	25.94
Economic Benefit	0	98.806	0	0.226	0.741	0.227
Composition PT+EB	0	78.6756	0	0.1356	10.6766	10.5122

Table 5. Transmission Expansion Cost allocations for the new line 2-8 that added the system with  $\alpha = 0.5$ 

	% $G_1$	% $G_2$	% $G_3$	% $D_5$	% $D_7$	% $D_9$
Proportional Tree	0	48.48	0	0	25.58	25.94
Economic Benefit	0	98.806	0	0.226	0.741	0.227
Composition PT+EB	0	73.643	0	0.113	13.1605	13.0835

Table 6. Transmission Expansion Cost allocations for the new line 2-8 that added the system with  $\alpha = 0.6$ 

	% $G_1$	% $G_2$	% $G_3$	% $D_5$	% $D_7$	% $D_9$
Proportional Tree	0	48.48	0	0	25.58	25.94
Economic Benefit	0	98.806	0	0.226	0.741	0.227
Composition PT+EB	0	68.6104	0	0.0904	15.6444	15.6548



## 7. Conclusion

Based on economic benefit and use of system, we proposed a scheme for cost allocation of transmission line expansion to tool with congestion problem in the network. To examine the proposed approach, a case study with a market model is used as a demonstrated example. As a further research topic, it is necessary to take into account detailed information as well as regulation policy in electric power market with large-scale systems for transmission expansion cost allocation. Based on proposed theory, the allocation takes into account the physical and economic impacts of the new transmission assets. The payments made by each participant are calculated using the economic benefit and use of system and are based on the increase in social welfare brought about by the new assets, the pre-investment surpluses of the players, and the influence the different market participants may have on the expansion decision. Reimbursements are provided where necessary, so that all firms have incentives to support the expansion. The numerical example demonstrates that the presented method is a simple, direct and fast way to determine the transmission expansion cost in the basis of the electric power market.

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## Fuzzy Fractional Initial Value Problems

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**Abstract:** In this paper we define fuzzy fractional derivative in Caputo sense. Then using Adomian decomposition method we propose a method for computing approximations of solution of fuzzy fractional initial value problems. [Abdorrezza Panahi, Azam Noorafkan Zanjani. Fuzzy Fractional Initial Value Problems. Journal of American Science 2011;7(4):427-431]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Key words:** Fuzzy initial value problems, Caputo fractional derivative, Adomian decomposition method

### 1. Introduction

Fractional differential equations with fuzzy initial value will form fuzzy fractional initial value problems. In recent years, fractional differential equations have found applications in many problems in physics and engineering [15], [16]. Benchohra and Darwish [8] introduced an existence and uniqueness theorem for fuzzy integral equation of fractional order and under some assumptions gave a fuzzy successive iterations which were proved to be uniformly convergent to the unique solution of fuzzy fractional integral equation. In the present paper we will use crisp successive iterations. Differential equations which arise in real-world physical problems are often too complicated to solve exactly. We propose a method for computing approximations of solution of a fuzzy fractional initial value problem using Adomian decomposition method. The Adomian decomposition method has been shown [18] to solve effectively, easily, and accurately a large class of nonlinear problems with approximations converging rapidly to accurate crisp solutions in crisp problems. Here we use the advantage of this method to find an approximate solution for the fuzzy fractional initial value problem with fractional derivative in Caputo sense.

### 2. Notations and preliminaries

First we recall some basic definitions concerning fuzzy numbers. Let  $E$  denote the class of fuzzy sets on the real line.

**Definition 2.1.** We write  $A(x)$ , a number in  $[0,1]$ , for the membership function of  $A$  evaluated at  $x$ . An  $\alpha$ -cut of  $A$  written  $A_\alpha$  is defined as  $\{x | A(x) \geq \alpha\}$ , for  $0 < \alpha \leq 1$ . We separately define  $A_0$  as the closure of the union of all the  $A_\alpha$ ,  $0 < \alpha \leq 1$ .

The parametric form of a fuzzy number can be defined as follows. According to the representation theorem for fuzzy numbers or intervals [10], we use  $\alpha$ -cut setting to define a fuzzy number or interval.

**Definition 2.2** [10]. A fuzzy number (or interval)  $u$  is completely determined by any pair  $u = (u^-, u^+)$  of functions  $u^\pm : [0,1] \rightarrow R$ , defining the end-points of the  $\alpha$ -cuts, satisfying the three conditions:

- (i)  $u^- : \alpha \rightarrow u^-_\alpha \in R$  is a bounded monotonic increasing (non-decreasing) left-continuous function  $\forall \alpha \in (0,1]$  and right-continuous for  $\alpha = 0$ ;
- (ii)  $u^+ : \alpha \rightarrow u^+_\alpha \in R$  is a bounded monotonic decreasing (non-increasing) left-continuous function  $\forall \alpha \in (0,1]$  and right continuous for  $\alpha = 0$ ;
- (iii)  $u^-_\alpha \leq u^+_\alpha \quad \forall \alpha \in [0,1]$ .

If  $u^-_1 < u^+_1$  we have a fuzzy interval and if  $u^-_1 = u^+_1$  we have a fuzzy number; for simplicity we refer to fuzzy numbers as intervals.

We will then consider fuzzy numbers of normal and upper semicontinuous form also we assume that the support  $[u^-_0, u^+_0]$  of  $u$  is compact (closed and bounded). The notation  $u_\alpha = [u^-_\alpha, u^+_\alpha]$ ,  $\alpha \in [0,1]$  denotes explicitly the  $\alpha$ -cuts of  $u$ .

We use a metric in  $E$  by the relation

$$D(u, v) = \sup_{0 \leq \alpha \leq 1} d(u_\alpha, v_\alpha)$$

where  $d$  is the Hausdorff metric [17], for nonempty compact subsets of  $R$ .

**Definition 2.3** A mapping  $F : I \rightarrow E$  is strongly measurable if for all  $\alpha$ , ( $0 < \alpha \leq 1$ ),  $F_\alpha(t)$  is

Lebesgue measurable for any  $t \in I$ , where  $F_\alpha(t) = [F(t)]^\alpha$ .

**Definition 2.4** A mapping  $F: I \rightarrow E$  is called levelwise continuous at  $t_0 \in I$  if all its  $\alpha$ -levels  $F_\alpha(t) = [F(t)]^\alpha$  are continuous at  $t = t_0$  with respect to the metric  $d$ . And  $F$  is called integrably bounded if there exist an integrable function  $h$  such that  $|x| \leq h(t)$  for all  $x \in [F(t)]^0$ .

We define

$$F_\alpha(t) = [F(t)]^\alpha = [F_1(t, \alpha), F_2(t, \alpha)]$$

as  $\alpha$ -levels of the mapping  $F: I \rightarrow E$ . A function  $f: I \rightarrow R$  is said to be a measurable selection of  $F_\alpha(t)$  if  $f(t)$  is measurable and

$$F_1(t, \alpha) \leq f(t) \leq F_2(t, \alpha)$$

for all  $t \in I$ .

**Definition 2.5** Let  $F: I \rightarrow E$ . The integral of  $F$  over  $I$  is defined levelwise by the equation  $[\int_I F(t)dt]^\alpha = \int_I F_\alpha(t)dt = \{\int_I f(t)dt \mid f: I \rightarrow R \text{ is a measurable selection for } F_\alpha\}$ , for all  $0 < \alpha \leq 1$ .

**Theorem 2.1** If  $F: I \rightarrow E$  is strongly measurable and integrably bounded, then  $F$  is integrable.

**Definition 2.6** [16]. Riemann-Liouville's fractional derivative and fractional integral of order  $r$  ( $0 < r < 1$ ) for  $u(t): R \rightarrow R$  are defined as

$$D^r u = \frac{1}{\Gamma(1-r)} \frac{d}{dt} \int_0^t (t-s)^{-r} u(s) ds$$

and

$$I^r u(t) = \frac{1}{\Gamma(r)} \int_0^t (t-s)^{r-1} u(s) ds. \quad (1)$$

**Definition 2.7** Caputo fractional derivative of order  $r$  ( $0 < r < 1$ ) for  $u(t): R \rightarrow R$  is defined as

$$D_c^r u = \frac{1}{\Gamma(1-r)} \int_0^t (t-s)^{-r} \left( \frac{d}{ds} u(s) \right) ds \quad (2)$$

**Definition 2.8** A function  $y(t)$ ,  $t > 0$  is said to be in the space  $C_\mu$ ,  $\mu \in R$ , if there exist a real number  $p > \mu$  such that  $y(t) = x^p y_1(t)$ , where  $y_1(t) \in C(0, \infty)$ , and is said to be in the space  $C_\mu^n$  if and only if

$$y^{(n)} \in C_\mu, \quad n \in N.$$

**Lemma 2.1** [11]. Let  $n-1 < r \leq n$ ,  $n \in N$  and  $y(t) \in C_\mu^n$ ,  $\mu \geq -1$ , then

$$I^r D_c^r y(t) = y(t) - \sum_{k=0}^{n-1} y^{(k)}(0^+) \frac{t^k}{k!}$$

To perform the Adomian decomposition method, the fractional initial value problem can be modeled as  $Ly(t) + Ny(t) + Ry(t) = 0$ , where  $L = D_c^r$  therefore  $L^{-1} = I^r$ . Since  $L^{-1}Ly = y - ct^{r-1}$  then

$$y = ct^{r-1} + -I^r(Ry) - I^r(Ny). \quad (3)$$

The solution  $y$  is represented as an infinite sum

$$y = \sum_{n=0}^{\infty} y_n \quad (4)$$

and the nonlinear term  $Ny$  will be decomposed by the infinite series of Adomian polynomials

$$Ny = \sum_{n=0}^{\infty} A_n$$

where the  $A_n$ s are obtained by writing

$$z(\lambda) = \sum_{n=0}^{\infty} \lambda^n y_n$$

$$N(z(\lambda)) = \sum_{n=0}^{\infty} \lambda^n A_n$$

therefore, for any  $n = 0, 1, \dots$

$$A_n = \frac{1}{n!} \left[ \frac{d^n}{d\lambda^n} N(z(\lambda)) \right]_{\lambda=0}.$$

Then substituting (3) in (4) we obtain the following relations

$$\sum_{i=0}^{\infty} y_i = ct^{r-1} - \sum_{i=0}^{\infty} I^r(Ry_i) - \sum_{i=0}^{\infty} I^r(A_i)$$

and we define  $y_0, y_1, y_2, \dots$  in a recurrent manner.

$$y_0 = ct^{r-1}$$

$$y_1 = -I^r Ry_0 - I^r A_0$$

$$y_2 = -I^r Ry_1 - I^r A_1$$

The truncated series  $\sum_{i=0}^N y_i$  could be as approximate solution.

### 3. Fuzzy initial value problem

Until now, there have been several methods to deal with the fuzzy initial value problem. Consider the fuzzy initial value problem

$$x'(t) = f(t, x(t)), \quad x(0) = x_0 \in E. \quad (5)$$

There are many suggestions to define a fuzzy derivative and in consequence, to study Eq. (5), see for instance [1]-[7], [9], [12]-[15], [17].

**Definition 3.1** A function  $F : [a, b] \rightarrow E$  is differentiable at a point  $t_0 \in (a, b)$ , if there is such an element  $F'(t_0) \in E$ , that the limits

$$\lim_{h \rightarrow 0^+} \frac{F(t_0 + h) \overset{H}{-} F(t_0)}{h} \quad \text{and} \quad (I)$$

$$\lim_{h \rightarrow 0^+} \frac{F(t_0) \overset{H}{-} F(t_0 - h)}{h}$$

or

$$\lim_{h \rightarrow 0^-} \frac{F(t_0 + h) \overset{H}{-} F(t_0)}{h} \quad \text{and} \quad (II)$$

$$\lim_{h \rightarrow 0^-} \frac{F(t_0) \overset{H}{-} F(t_0 - h)}{h}$$

exist and are equal to  $F'(t_0)$ . Here the limits are taken in the metric space  $(E, D)$  and  $\overset{H}{-}$  is the Hakuvara difference.

In the next section we will define more general type of differentiability for fuzzy fractional differential equations. Now, for  $F : [a, b] \rightarrow E$ , we easily obtain the following result:

**Theorem 3.1** [12]. Let  $F : [a, b] \rightarrow E$  be differentiable and denote  $[F(t)]^\alpha = [F_1(t, \alpha), F_2(t, \alpha)]$ .

Then

(i) If  $F$  is differentiable of type (I), then  $F_1$  and  $F_2$  are differentiable and

$$[F'(t)]^\alpha = [F'_1(t, \alpha), F'_2(t, \alpha)],$$

(ii) If  $F$  is differentiable of type (II), then  $F_1$  and  $F_2$  are differentiable and

$$[F'(t)]^\alpha = [F'_2(t, \alpha), F'_1(t, \alpha)].$$

#### 4. Fuzzy fractional initial value problem

In Eq. (5), we will replace the first derivative of  $x$  with the fractional derivative of  $x$  in Caputo sense. We use the definition of Caputo's fractional derivative of a crisp function in Eq. (2) to

define fuzzy fractional derivative. Let  $x : [0, T] \rightarrow E$  be a fuzzy function of a crisp variable. For  $[x(s)]^\alpha = [x_1(s, \alpha), x_2(s, \alpha)]$ , we have  $[x'(s)]^\alpha = [x'_1(s, \alpha), x'_2(s, \alpha)]$  since  $t - s > 0$  then  $D_c^r x(t)$  can be defined levelwise as

$$[D_c^r x(t)]^\alpha = [D_c^r x_1(t, \alpha), D_c^r x_2(t, \alpha)]$$

$$= \left[ \frac{1}{\Gamma(1-r)} \int_0^t (t-s)^{-r} x'_1(s, \alpha) ds, \right.$$

$$\left. \frac{1}{\Gamma(1-r)} \int_0^t (t-s)^{-r} x'_2(s, \alpha) ds \right]$$

Consider the following initial value problem with fractional derivative

$$\begin{cases} D_c^r x(t) = f(x, t), & t \in [t_0, T] \\ x(t_0) = x_0 \in E, & t_0 \in [0, T] \end{cases} \quad (6)$$

In general, it is too difficult to find an exact analytical solution for (6), so we will try to find an approximate analytical solution.

**Theorem 4.1** Let  $0 < r < 1$  and  $x : [a, b] \rightarrow E$  be a fuzzy function with  $[x(t)]^\alpha = [x_1(t, \alpha), x_2(t, \alpha)]$ .

Then

(i) If  $x$  has fractional derivative of type (I), then  $x_1$  and  $x_2$  have fractional derivative and

$$[D_c^r x(t)]^\alpha = [D_c^r x_1(t, \alpha), D_c^r x_2(t, \alpha)]$$

(ii) If  $x$  has fractional derivative of type (II), then

$x_1$  and  $x_2$  have fractional derivative and

$$[D_c^r x(t)]^\alpha = [D_c^r x_2(t, \alpha), D_c^r x_1(t, \alpha)]$$

**Proof.** We prove part (i) and the same proof can be used for part (ii). Since  $0 \leq s \leq t$  and

$$[x(t)]^\alpha = [x_1(t, \alpha), x_2(t, \alpha)]$$

Then

$$[x'(s)]^\alpha = [x'_1(s, \alpha), x'_2(s, \alpha)]$$

$$[(t-s)^{-r} x'(s)]^\alpha = [(t-s)^{-r} x'_1(s, \alpha), (t-s)^{-r} x'_2(s, \alpha)].$$

Since  $0 < r < 1$ , then  $\Gamma(1-r) > 0$ , therefore

$$\left[ \frac{1}{\Gamma(1-r)} \int_0^t (t-s)^{-r} x'(s) ds \right]^\alpha =$$

$$\left[ \frac{1}{\Gamma(1-r)} \int_0^t (t-s)^{-r} x_1'(s, \alpha) ds, \right.$$

$$\left. \frac{1}{\Gamma(1-r)} \int_0^t (t-s)^{-r} x_2'(s, \alpha) ds \right]$$

So

$$[D_c^r x(t)]^\alpha = [D_c^r x_1(t, \alpha), D_c^r x_2(t, \alpha)]$$

#### Remark 4.1 When

$$[f(t, x)]^\alpha = [f_1(t, x_1(t, \alpha), x_2(t, \alpha)), f_2(t, x_1(t, \alpha), x_2(t, \alpha))]$$

then we translate the fuzzy fractional initial value problem (6) into a system of fractional initial value problems.

$$\begin{cases} D_c^r x_1(t, \alpha) = f_1(t, x_1(t, \alpha), x_2(t, \alpha)), \\ x_1(t_0, \alpha) = x_1^{0, \alpha} \\ D_c^r x_2(t, \alpha) = f_2(t, x_1(t, \alpha), x_2(t, \alpha)), \\ x_2(t_0, \alpha) = x_2^{0, \alpha} \end{cases} \quad (7)$$

when part (i) of Theorem 4.1 holds and

$$\begin{cases} D_c^r x_1(t, \alpha) = f_2(t, x_1(t, \alpha), x_2(t, \alpha)), \\ x_1(t_0, \alpha) = x_1^{0, \alpha} \\ D_c^r x_2(t, \alpha) = f_1(t, x_1(t, \alpha), x_2(t, \alpha)), \\ x_2(t_0, \alpha) = x_2^{0, \alpha} \end{cases} \quad (8)$$

when part (ii) of Theorem 4.1 holds. In these equations  $[x(t_0)]^\alpha = [x_1^{0, \alpha}, x_2^{0, \alpha}]$  is a fuzzy initial value.

In each case, the system of crisp fractional initial value problems will be solved by Adomian decomposition method. Finally, it must be verified whether the results make  $\alpha$ -levels of a fuzzy number. When the result is a fuzzy number, by substituting in the (9) and using metric  $D$  the error of approximate solution will be obtained.

#### 4. Conclusion

Fuzzy fractional differential equations have been introduced in Caputo sense. Adomian decomposition method has been applied to obtain approximate fuzzy solution. Although the method given in this paper is for the fuzzy fractional initial

value problem, it might also be applicable to fuzzy fractional partial differential equations.

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## A model for health services priority setting for Iran

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**Abstract:** Although priority setting has a long history, but until recent years even developed countries have mainly relied on implicit methods for priority setting. But the evidence show that implicit priority setting is not acceptable since this method neither lead to benefit maximization, nor consider issues such as equity, equality and community participation. Hence it is necessary to design a model which is capable of overcoming these issues. Present qualitative research was carried out in six phases: 1. identifying models 2. Identifying attributes 3. ranking attributes 4. Evaluation of the models 5. Developing primary model 6. Validating primary model through Delphi technique. Content analysis and descriptive statistics were used for data analysis. Ten priority setting models identified. Evaluation of the models based on performance criteria demonstrated that HSW-DBM and ACE had the best performance against the criteria. On the other hand, historical allocation and decibels had the worst performance. suggested model better satisfies the performance criteria compared to existing models. The suggested model is enough flexible to be used at different levels and different settings of the health system. Applying this model can guide decision makers and policy makers toward optimum resource utilization and fair distribution.

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**Key words:** Economic approach, Priority setting model, Disease based model, Evidence based priority setting.

### 1. Introduction

Health care, like other public goods and personal services, does not operate in an environment of unlimited resources (Wolfe and Stange, 2006). Increasing health care public expenditures have led policymakers around the world to focus their attention on the subject of priority setting (Robinson, 1993). Priority setting is arguably the most important health policy issue of our time. No health system, whether primarily publicly funded or privately funded can afford to provide every service it may wish to provide (Kapiriri and Noreheim, 2004; Martin and Singer, 2003; Klein, 1999), this is specially true in developing countries (Kapiriri and Noreheim, 2004).

The primary task of priority setting is to determine desirable resource shifts- health services to be expanded and those to be contracted- to support the achievement of health and other social objectives (Segal and Mortimore, 2006). Different models and institutional arrangements have been developed to help doing this task (Robinson, 1993). No easy solutions are available for priority setting, so it is necessary that countries develop an information set to facilitate decision making. This process needs transparent approach and explicit debate about the principles and criteria to be used to make decisions about allocating health care resources (Kapiriri and Noreheim, 2004).

Although solutions differ, what unites them is the need to target and prioritize public spending. This

is especially relevant in countries where funding levels fall much short to provide a comprehensive set of essential health services (Baltussen, 2006). In developing countries resources may be excessively concentrated in urban facilities serving the middle and upper classes. The poor especially in rural areas are left with low- quality public services (Streefland, 2005). In addition, resources are often being spent on low impact services such as curative care of non catastrophic illness (Overseas Development Institute, 2003). These inequities and inefficiencies indicate the need for a careful use of scarce public resources in health which could be guided by a more rational approach (Baltussen, 2006; Martin and Singer, 2000; Segal and Chen, 2001a).

Although, there is growing interest in priority setting, there is little consensus on the best way to carry it out, different approaches have been proposed, ranging from guidelines, checklists and minimum packages to explicit criteria (Kapiriri and Noreheim, 2004). Iran as a developing country has measured the burden of disease at the national level but it has not been applied as a guide for priority setting until now.

Since there is no unique model for priority setting to be used worldwide, we carried out this study in order to develop a customized health services priority setting model for Iran.

### 2. Material and Methods

This study was carried out in following phases:

1.Literature review in order to explore main procedures and techniques used to guide priority setting which could be retrieved through web search.

2.We identified 19 attributes which were important for an evidence based priority setting model through literature review and interviews with informants.

3.We changed 19 identified attributes into a Likert scale questionnaire and asked the 36 informants (experts, policy makers) to score the attributes based on their properness to be part of performance criteria. Of 36 distributed questionnaire 26 were answered completely with response rate of 72.22 percent

4.We selected first 9 highest ranked attributes to develop performance criteria against which we assessed the identified priority setting models in using the following scoring method suggested by Mullen[12]

-meets the proposed criteria well- allocate 7-9 points

-meets the criteria average – allocate 4-6 points

-meets criteria poorly- allocate 1-3 points

5.We developed our recommended model for use in Iranian health services priority setting based on the model which met performance criteria best after validation via Delphi technique in three rounds.

Sample: We used the purposeful sampling method to explore the experts and policy makers with at least 2 of these qualifications:

-minimum 10 years experience in health services policy making

-academic education in related fields (health services administration, health economics or health policy making)

-Experience in health services priority setting

We could find 36 participants with mentioned characteristics of them 26 answered the questionnaire completely

### 3. Results

#### Priority setting models

The literature review revealed priority setting models which can be categorized in 2 broad groups 1. Non-economic approaches to priority setting 2. Economic approaches to priority setting (Mitton and Donaldson, 2004a) these models are summarized in table 1. The main characteristic which distinguishes economic approaches from non- economic ones is the emphasis put by economic models on economic principles.

#### Priority setting models important attributes:

We reviewed the literature and also interviewed informants to explore 19 attributes which are expected from any priority setting model i.e. we expect that a desirable priority setting model should bring in. These attributes are summarized in table 2.

**Table 1. Healthcare priority setting models**

Non- economic models	Economic models
- Historical allocation and decibel (Mitton and Donaldson, 2004a)	- QALY league tables (Coast et al, 1996)
- Burden of disease (Segal and Chen, 2001a; Segal and Chen, 2001b; Wiseman and Mooney, 1998).	- Economic evaluation techniques (Mitton and Donaldson, 2004a; Drumond et al, 2005)
- Target and Goals (Segal and Chen, 2001a ; Segal and Chen, 2001b)	- Program budgeting and marginal analysis ( PBMA) (Mitton and Donaldson, 2004a; Mitton and Donaldson, 2004b)
- Cost of illness (Segal and Chen, 2001a ; Segal and Chen, 2001b)	- Assessment of cost effectiveness (ACE) (Segal and Chen, 2001a ; Segal and Chen, 2001b; Segal and Mortimore, 2006)
- Defining core services (Mitton and Donaldson, 2004a)	- Health sector wide disease based model (HSW-DBM) (Segal and Chen, 2001a ; Segal and Chen, 2001b; Segal and Mortimore, 2006)

**Table2. Priority setting models important attributes**

Attribute	Score
1. Considering economic principles i.e. marginal analysis and opportunity costs	4.69
2. Decision rule is explicit about how to achieve optimal combination of services	4.61
3. Equity concerns is addressed	4.42
4. Considering existing and potential interventions rather than	4.34
5. Possibility for implementation based on possibilities and limitations of the society	4.27
6. A mechanism for evaluating the priority setting process is predicted	4.23
7. A mechanism is predicted for consumers and public involvement	4.11
8. Suitable method for measuring costs and benefits of different interventions is predicted	4.07
9. The national priorities can be incorporated	4.03
10. The flexibility is incorporated so that the model can be used at different levels	3.96
11. Priority setting process is carried out in an explicit manner	3.96
12. Decision making is based on explicit evidence	3.92
13. Priority setting processes are politically acceptable	3.84
14. A mechanism for stakeholders participation is defined	3.76
15. Considering specific conditions of any region	3.65
16. Considering the efficiency improvement	3.57
17. Priority setting objectives are cleared	3.57
18. Enabling resource shifts among different sectors and programs	3.54
19. Decision making about interventions is not restricted to ministry of health	3.30

#### **-Evaluating Priority setting models important attributes**

The 26 completed questionnaires revealed that “considering economic principles” i.e. marginal analysis and opportunity costs and “decision rule is explicit about how to achieve optimal combination of services” received the highest scores (see table 2) while “Decision making about interventions is not restricted to ministry of health” and “Enabling resource shifts among different sectors and programs” received the lowest scores (see table 2). However the fact that all attributes received scores more than 3 is not surprising, since all these attributes are desirable expectations of any priority setting approach.

#### **- Performance Criteria**

We chose first 9 highest ranked attributes from table 2 in order to form the performance criteria against which the priority setting models are compared. In

the final list the attributes could be categorized under following labels:

- Economic attributes (items 1, 2 and 8)
- social attributes (items 3,4 and 7)
- potential of implementation attributes (items 5,6 and 9).

#### **Comparing priority setting models against performance criteria**

We compared identified models against performance criteria and allocated scores according to their compatibility with performance criteria attributes. The final scoring revealed that HSW-DBM and ACE models received the highest scores while historical allocation and decibels and Goals and targets models received the lowest scores

Developing model

HSW-DBM and ACE models have the best performance against criteria. Therefore, we decided to base our model on HSW-DBM and try to

overcome the weaknesses using ACE features. As a result, we developed the refined HSW-DBM which is more suitable for our health system than the original one. The refined HSW-DBM is consisted of the following stages (illustrated in figure 1).

#### 4. Discussions

##### A- Model discussion:

Priority setting using this model involves detailed tasks in each stage

1. In the first stage “Preliminary activities” following tasks have to be done:

-Identify priority setting objective(s): these objectives might be:

- Achieving allocative efficiency using existing resources
- Allocating new resources in order to achieve allocative efficiency
- Determining contraction candidates when the resources are decreased and etc.

- Define priority setting scope

This task is very important since it determines analysis extension, maybe to cover the health sector wide.

-Identifying stakeholders

Here based on the scope of priority setting all the stakeholders have to be identified

-Form advisory working group

This advisory group must have members of identified stakeholders and for technical reasons a health economist and clinician.

-Determine decision criteria: decision criteria is based on community values, equity, access and political acceptability

Forming this group by incorporating key stakeholders increases the probability of implementing the recommendations.

2. Select a disease/health problem:

We used disease based approach for priority setting because of the following advantages: ensuring a focus on resource allocation between diseases stages, supporting staging of the research task with little risk of sub- optimization, capacity to observe distributional impacts, opportunity to use intermediate outcome measures and research efficiency(Segal and Chen, 2001b)

In order to choose the disease to begin priority setting process following guidelines may be useful:

- National priorities
- Disease severity
- Equity issues

- Access to information on cost and effectiveness

#### 3. Draw priority setting framework

In this stage following tasks are performed:

-obtain a thorough understanding of the disease health /problem in terms of disease etiology, normal disease progress and feasible points of intervention to reduce disease burden

-Draw the priority setting framework based on through understanding of the disease.

-Extend the analysis based on priority setting scope for example in Iran, health centers in rural and urban areas are mainly concerned with primary and secondary care as a result, the priority setting framework for services provided by these centers would be limited to pertaining disease stage.

-Identify all potential intervention options at each disease stage processing cell by cell, down a column regardless of the modality, health delivery setting, target population, etc.

-Select interventions to include in the priority setting exercise contingent upon constraints related to the availability of data

#### 4. Determine the cost/benefit ratio of the interventions

In this stage following tasks are performed:

-Specify the measure of benefit: the selected measure of benefit should allow comparison between and within disease stages, if possible a final outcome measure.

-Collect evidence on costs and outcomes from published clinical trial literature

-Calculate the cost effectiveness of each intervention at each disease stage

-Rank the identified interventions based on their cost/outcome ratio

-Make primary recommendation on desirable resource shifts i.e. from least cost- effective interventions to best cost- effective interventions.

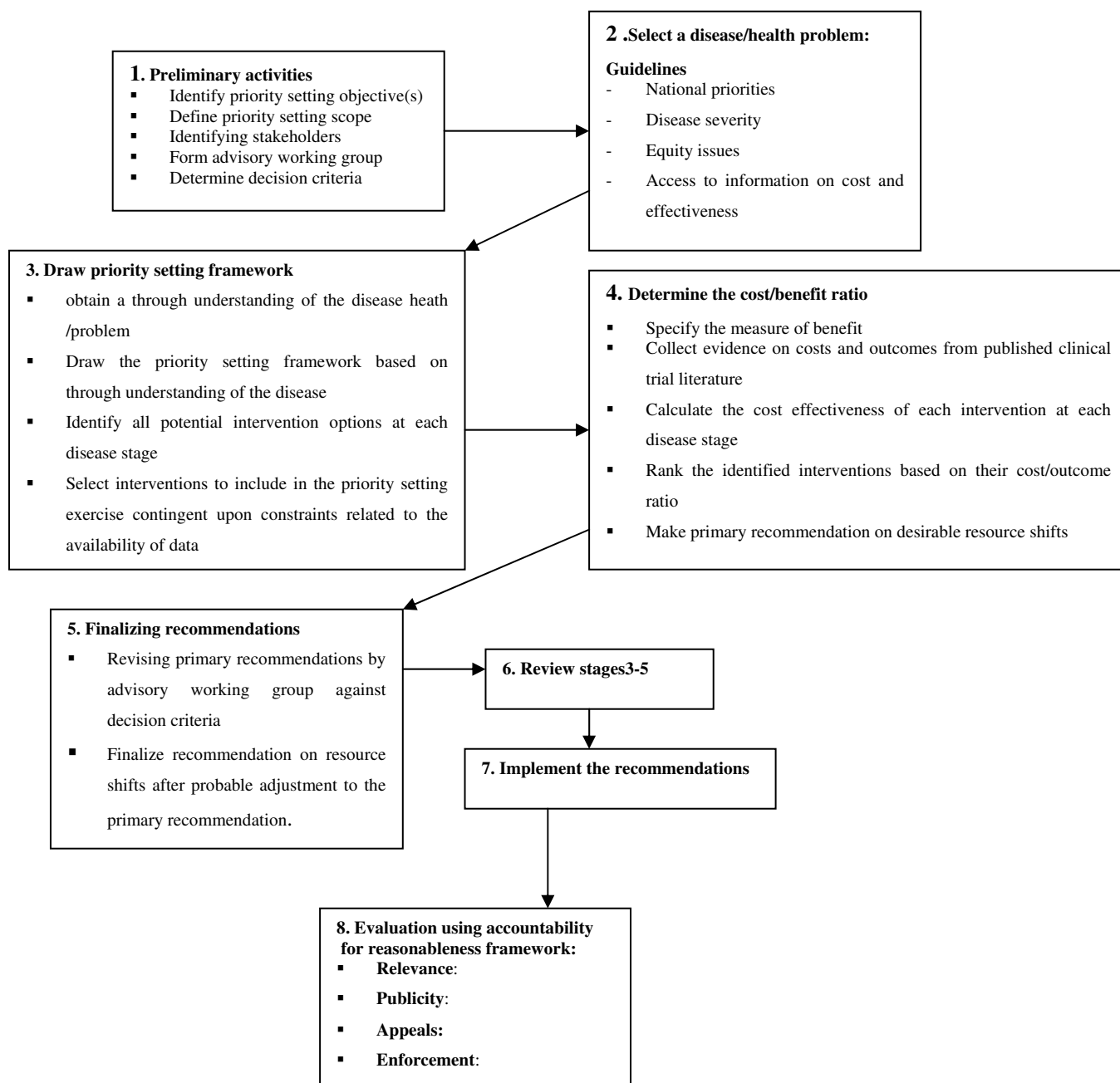
#### 5. Finalizing recommendations

- Revising primary recommendations by advisory working group against decision criteria

In this stage the recommendations are revised by working group using decision criteria. This stage although undermine the evidence base of the model but instead increases the acceptability of model for stakeholders and as a result, there will be fewer barriers for implementing the recommendations.

-Finalize recommendation on resource shifts after probable adjustment to the primary recommendation.



**Figure 1. Refined HSW\_DBM**

6. Review stages 3-5

7. Implement the recommendations

8. Process evaluation: like any other process, priority setting needs a stage for evaluation, although in the suggested model some sort of evaluation is predicted in stage 6, but that is not sufficient since it is partial and only focus on 3 stages of the process. In order to obtain a thorough evaluation we recommend using accountability for reasonableness framework suggested by Daniels and Sabin: (Martin and Singer, 2003; Segal and Mortimor, 2006; Martin and Singer, 2000; Segal and Chen, 2001b; Kipiriri and Martin, 2006; Kipiriri and Norheim, 2007; Martin et al, 2003; Martin, 2007; Daniels and Sabin, 2002).

- Relevance: Rationales for priority setting decisions must rest on reasons (evidence and principles) that “fair-minded” people can agree are relevant in the context. “Fair-minded” people seek to cooperate according to terms they can justify to each other—this narrows, though does not eliminate, the scope of controversy, which is further narrowed by specifying that reasons must be relevant to the specific priority setting context.
- Publicity: Priority setting decisions and their rationales must be publicly accessible—justice cannot abide secrets where people’s well being is concerned.
- Appeals: There must be a mechanism for challenge, including the opportunity for revising decisions in light of considerations that stakeholders may raise.
- Enforcement: There is either voluntary or public regulation of the process to ensure that the first three conditions are met.

## B- Comparison with other models

The revised health sector wide disease base model has elements in common with other economic based approaches such as PBMA (Segal and Mortimor, 2006; Mitton and Donaldson, 2004a; Segal and Chen, 2001b; Mitton and Donaldson, 2004b; Mitton and Donaldson, 2002; Mitton, 2002; Mitton and Donaldson, 2003), QALY league table (Segal and Mortimor, 2006; Mitton and Donaldson, 2004a; Segal and Chen, 2001b; Mitton and Donaldson, 2003) and specially with ACE (Segal and Mortimor, 2006; Segal and Chen, 2001b) and HSW-DBM (Segal and Mortimor, 2006; Segal and Chen, 2001b). In this part refined HSW-DBM is compared with those models in brief.

## Comparison with PBMA:

### Commonalities :

- Taking marginal perspective and considering opportunity costs as two main economic principles.
- Considering issues such as equity, community values, and access in decision criteria set.
- Forming advisory group in order to finalize the resource shifts

### Distinctions:

Refined HSW-DBM is distinguished from PBMA model in following aspects:

- PBMA is a program based model for priority setting while the refined HSW-DBM is a disease based model.
- PBMA heavily relies on expert panel in order to set up expansion and contraction list and to develop desirable resource shifts but our model although considers Advisory working group suggestions, but primarily is an evidence based approach to priority setting.
- PBMA has no formal mechanism to evaluate the process but refined HSW-DBM evaluates the whole process via Accountability for reasonableness framework in order to ensure the process is fair and explicit. This feature of our model is unique, although numerous studies has been done to evaluate the priority setting process using accountability for reasonableness framework (Martin and Singer, 2003; Segal and Mortimor, 2006; Martin and Singer, 2000; Segal and Chen, 2001b; Kipiriri and Martin, 2006; Kipiriri and Norheim, 2007; Martin et al, 2003; Martin, 2007; Daniels and Sabin, 2002) but none of them has integrated this framework as part of an evidence based model.

## Comparison with Assessment of cost effectiveness:

### Commonalities:

- Taking marginal perspective and considering opportunity cost as two main economic principles.
- Forming the advisory working group and using similar decision criteria and tasks
- Relying on published evidence on effectiveness to rank different suggested interventions as the first stage filters.
- The role of second stage filters (community values, national priorities, equity, access and etc.) in the final ranking of interventions.

- Community participation is predicted in both models.

#### **Distinctions:**

- ACE model is limited to programs but the refined HSW-DBM is capable of extending to the whole health sector.
- ACE model recommend use of DALY as the primary outcome measure but in the refined HSW-DBM no single outcome measure is determined and the selection of outcome measure will be as part of the priority setting process.
- We have included a stage titled as preliminary activities at the beginning of the process which consists of activities very important to the whole process but the ACE model lacks this stage.
- Applying accountability for reasonableness as the framework for evaluation of the process is another distinction of our model relative to ACE model.

#### **Comparison with original HSW-DBM:**

The HSW-DBM has much in common with the suggested model since our model is based on HSW-DBM, notably the disease focus and great reliance on objective evidence, other similarities are as followings:

- Adoption of marginal perspective and considering opportunity costs.
- Health sector wide planning framework
- Similar criteria to decide on the disease by which the process begins.
- Similar decision criteria on resource shifts within and between disease stages.

#### **Distinctions:**

Where the HSW-DBM differs from suggested model is in the role of the advisory working group in selecting intervention options resource shifts, rather than the use of objective criteria for this process, onset of the suggested process with “preliminary activities” in order to increase the chance of implementation of the recommendations, the role of second stage filters in final ranking of interventions and finally adoption of the accountability for reasonableness as the standard framework for evaluating the process.

#### **Limitations:**

There are some limitations in our study which may affect its applicability in other developing countries some of them are:

- The proposed decision criteria against which the priority setting models were compared

were prepared based on Iranian health policy makers and experts. Since in each nation the value system, concerns, needs and health problems differ so decision criteria might be different if it was based on other countries experts

#### **Conclusion:**

The revised HSW-DBM for adoption by Iranian health sector largely follows the structure of the HSW-DBM but also incorporating some aspects from the ACE model and integrates the well known frame work of accountability for reasonableness to model. The most important part of the model is its first and last stages. In the first stage by determining the objective(s) and scope of priority setting the stakeholders are identified and we can incorporate them in the working party in order to facilitate the process and when the objective is clear we can adjust our next activities based on objective(s), scope and criteria.

A very interesting feature of the HSW-DBM which is true for our model is its flexibility which makes it suitable for different settings priority setting. Since it is capable of encompassing the whole health sector, it can be easily applied at any other level. For example it might be useful in defining benefit package for insurance companies in Iran to define basic insurance benefit package.

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## Transmission Fixed Cost Allocation in Deregulated Environment based on Cooperative Game Theory

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**Abstract:** The cooperative game theory is proposed to the transmission fixed cost allocation incurred to accommodate all the players. This method dominates the difficulties of conventionally used methods, such as postage stamp method and MW miles method, and encouraging the economically optimal usage of the transmission facilities. Under the deregulated environment, the cost needs to be allocated to the loads as well as generators fairly and unbiased so as to provide a locational signal to both types of players for optimal setting. This paper proposes game theoretic models based on the Shapley value approaches for transmission cost allocation problems under the deregulated environment. The obtained results are compared with the conventionally adopted methodologies to defend easy implementation and effectiveness of the proposed methodologies.

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**Keywords:** Transmission Cost Allocation, Game Theory, Shapley Value, Coalition, Optimal Power Flow.

### 1. Introduction

The term fixed costs, generally, embraces the capital invested to build the network as well as the network maintenance costs. In a monopoly market, the utility covers those costs through the tariff policy. In the deregulated electricity markets, the network operation is the responsibility of the Independent System Operator (ISO). However, the company which is the network owner must still be compensated for those fixed costs. Hence, the ISO has to charge the market participants so as to collect the necessary amount.

In the deregulated power markets, the issue of charging the participants, regarding the fixed costs, is of great significance. The reason is that the fixed costs make up the largest part of transmission charges. Hence, it is easy to explain the demand for a fair and effective allocation of those costs to the market participants.

The problem therefore becomes how to allocate these costs among the players, who pays what portion of the overall cost [1].

The need to charge all players on an unbiased basis for transmission services made it an open research issue. Conclusion of the transmission cost should be simple and transparent. It is difficult to attain an efficient transmission pricing scheme that could fit all market structures in different countries. The continuous research on transmission pricing indicates that there is no generalized agreement on pricing methodology. In practice, each deregulation market has chosen a method that is based on the particular characteristic of its network. Measuring

whether or not a certain transmission pricing scheme is technically and economically adequate would require additional standards.

Various methods for allocation of transmission cost have been reported in the literature. The most common and simplest approach is the postage stamp method, which depends only on the amount of power moved and the duration of its use, irrespective of the supply and delivery points, distance of transmission usage. Contract path method proposed for minimizing transmission charges does not reflect the actual flows through the transmission grid [2- 3].

As another, MW Mile method was introduced in which different users charged in proportion to their utilization of the grid [4]. The main key in MW Mile method is to find the contribution or share of each generator and each demand in each of the line flows.

Various methods reported for finding the share and contribution of generators and demands is flow based. J. Bialek has proposed a tracing method based on topological approach resulting in positive generation and load distribution factors [5]. D. Kirschen et al proposed a method to find the contributions of generators and loads by forming an acyclic state graph of the system making use of the concepts of domains, commons and links [6].

A. J. Conejo et al proposed a method to find the share of participants to transmission cost allocation by forming  $Z_{bus}$  that makes generator- load use the lines electrically close to it. The



$Z_{bus}$  present's numerical behavior model based on circuit theory and relates the nodal currents to line power flows [7].

Other methods that use generation shift distribution factors are dependent on the selection of the slack bus and lead to eristic results [8-11].

The usage-based method reported in [12] uses the so-called equivalent bilateral exchanges (EBEs). To build the EBEs, each demand is proportionally assigned a fraction of each generation, and conversely, each generation is proportionally assigned a fraction of each demand, in such a way as both Kirchhoff's laws are satisfied.

This paper presents a new method based on Game Theory for transmission cost allocation. Game theory is the study of multi player decision problems. In these problems there is conflict of interests between players. The term game corresponds to the theoretical models that describe such conflicts of interests.

## 2. Cooperative Game Theory Concepts

Several methods have been proposed aiming at a proper allocation of fixed costs. These methods are well established from an engineering point of view but some of them may fail to send the right economical signals. The allocation of the fixed costs is a typical case where the cooperation between some agents produces economies of scale. Consequently, the resulting benefits have to be shared among the participating agents. The cooperative game theory concepts, taking into account the economies of scale, suggest reasonable allocations that may be economically efficient. The analysis in this paper will illustrate the use of game theory in the fixed cost allocation.

Let  $N = \{1, 2, 3, \dots, n\}$  define the set of all the players in the game. A coalition  $S$  is defined as a subset of  $N$  that  $S \subset N$ . The null set is called the empty coalition and the set  $N$  is called the grand coalition. The game on  $N$  is a real valued function  $v: 2^N \rightarrow \mathbb{R}$  that assigns a worth to each coalition and satisfies  $v(\emptyset) = 0$ . The characteristic value  $v(S)$  gives the maximum gain the coalition  $S$  can guarantee itself by coordination or cooperation between its members, irrespective of what other players and coalitions do [11].

The application of cooperative game theory is to suggest an optimal or a fair allocation of the cost among its different players.

The cost allocation is represented in terms of a pay off vector denoted as  $\{\phi_1, \phi_2, \phi_3, \dots, \phi_n\}$  such that  $\sum_{i=1}^n \phi_i = v(N)$ . If the allocation needs to be

optimal and fair for all the players, three conditions, as given below, namely, individual, group and global rationalities need to be satisfied.

$$\phi(i) \leq v(i) \quad i \in N \quad (1)$$

$$\phi(S) \leq v(S) \quad S \subset N \quad (2)$$

$$\phi(N) = v(N) \quad (3)$$

Any pay off vector satisfying the individual and global rationalities is called an imputation. There are numerous methods for allocation of costs among the players of a cooperative game. This paper is widely based on one Cooperative Game methods, namely Shapley Value (SV) for obtaining a particular solution.

## 2.1 Shapley Value Approach

The Shapley Value is calculated as follows. Let  $v$  be the characteristic function and  $i$  be any player in the game. The cost of serving none is assumed to be zero, that is,  $v(0) = 0$ .

The variable  $S$  represents the number of players in the coalition containing  $i$ , and  $n$  is the total number of players in the game. Therefore, the allocation  $\phi_i$  to player  $i$  by the Shapley Value is determined by:

$$\phi_i(v) = \sum_{S \subseteq N-i} \frac{|S|(n-|S|-1)!}{(n-1)!} [v(S \cup i) - v(S)] \quad (4)$$

where

$S$  is the coalition excluding  $i$

$(S \cup i)$  is the coalition obtained by including  $i$

$|S|$  is the number of entities in coalition  $S$

$n$  is the total number of players

$v(S)$  is the characteristic value associated with coalition  $S$ .

In Equation (4), the first part of the expression gives the probability of a particular player joining that coalition and the second part gives the contribution that any particular player makes to the coalition by his joining.

The characteristic function  $v(S)$  of the proposed cooperative game is calculated as follows:

$$v(S) = \sum_{l \in S} P_l \times C_l \quad (5)$$

in which,  $v(S)$  is the fixed cost of providing transmission service to coalition  $S$ .  $P_l$  is the active power flowing through the line  $l$  that can be obtained from the Optimal Power Flow which it is explained in the next section,  $C_l$  is the transmission cost of active power through line  $l$ .

## 3. Optimal Power Flow

Optimal power flow (OPF) is performed on the case studies to obtain the different line flows passing for various possible coalitions between the generators and loads. OPF is performed supposing

peak load on all load buses, as peak loads justify the design of any transmission network. In all possible combinations, at least one generator and one load have always been taken to represent realistic coalitions.

In this paper, the problem has been formulated so as to transmission fixed cost allocation over the set of generators and loads using game theory. Both the generators as well as the loads are supposed to be using the transmission system, and so the cost is allocated between both types of players. This provides a locational signal to players to set at optimized locations. The loads are obliged to set at power surplus centers and generators at load centers.

This optimizes the overall cost of supplying power for a given set of loads. The game theory approach of the Shapley value is used to solve and obtain the cost allocation. The Shapley value was calculated using TuGames Package, an extension of Cooperative Games, a Mathematica Package [13].

The percentage cost allocation for each individual line is calculated and used with the line lengths to obtain allocation of the complete system cost between the different players.

#### 4. Test Case

To determine the allocation for players, the methods have been tested on three conditions, cases A, B modeling pool market and C modeling the bilateral transaction. Note that the cost of each line is considered to be proportional to its series reactance. Thus,

$$C_l = 1000 \times X_l \text{ (\$/h)} \quad (6)$$

##### A. First Case 5 Bus Power System

Figure 1 depicts a 5 bus test system, which is modeling the pool market that composed of three loads and two generators. The seven lines in the system have the same values of series resistance and reactance: 0.02 and 0.10 [pu] respectively. With considering the cost of each line  $C_l = 1000 \times X_l \text{ (\$/h)}$ , total transmission cost is equal 700 \$/h. The generators and load data is given in the Tables 1 and 2. It is supposed that two generators, G1 and G2, sell their production power to three loads in an open access transmission environment that a Transco responsible for providing the required transmission service and allocating the cost incurred to the participants involved in the service.

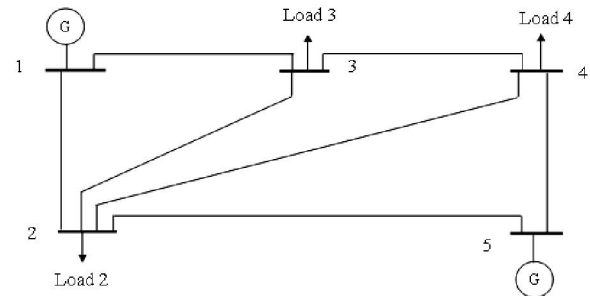


Figure 1. The single-line diagram of the 5 bus system

Table 1. Load data

Bus	P (MW)	Q (MW)
2	30	10
3	40	20
4	40	20

Table 2. Generators data

Coefficients of polynomial cost function ( $C_2 P^2 + C_1 P + C_0$ )				
Gen	Max Power (MW)	$C_0$	$C_1$	$C_2$
G1	250	150	5	0.09
G5	250	300	5	0.15

Let  $N = \{1, 2, 3\}$  represent the set of players in the game, which elements 1, 2 and 3 represent load 2, load 3 and load 4 respectively. Then  $S = (\{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\})$  denote all possible coalition between these three players. The optimal power flow is then simulated to determine the power flow ( $P_i$ ) through the network while taking the physical constraints into account. When there is no cooperation, that is the transmission network is used exclusively by each player, the value of the characteristic function in eqn 4 mentioned above for specific coalition  $\{1\}, \{2\}$  and  $\{3\}$  is as follows:

$$v(\{1\}) = 4383$$

$$v(\{2\}) = 6999$$

$$v(\{3\}) = 7283$$

However, if more than one player agrees to use the transmission network simultaneously, the power flow through some lines would drop due to the possible counter flow which relieves the congestion. In this condition, the characteristic function and its value for coalition  $\{1, 2\}, \{1, 3\}, \{2, 3\}$  should be as follows:

$$v(\{1, 2\}) = 9643$$

$$v(\{1, 3\}) = 10622$$

$$v(\{2, 3\}) = 12102$$

Further more the cost function of the grand coalition  $\{1, 2, 3\}$  would be as follows:

$$v(\{1, 2, 3\}) = 14370$$

It is obvious that the total characteristic function in cooperation is much less than when the network is employed monopoly by each load. Now the problem is how to distribute the total value according to each player's incremental effect to the coalition. Let  $\phi_i$  denote the value allocated to player  $i$  by the shapley value. Thus  $\phi_1$  was calculated as:

$$\phi_1 = \frac{0! \times 2!}{3!} [v(\{1\}) - v(\{1\} - \{1\})] +$$

$$\frac{1! \times 1!}{3!} [v(\{1, 2\}) - v(\{1, 2\} - \{1\})] +$$

$$\frac{1! \times 1!}{3!} [v(\{1, 3\}) - v(\{1, 3\} - \{1\})] +$$

$$\frac{2! \times 0!}{3!} [v(\{1, 2, 3\}) - v(\{1, 2, 3\} - \{1\})] = 3214.2$$

Similarly, the value allocated to player 2 and 3 is calculated as:

$$\phi_2 = 5262.2$$

$$\phi_3 = 5893.6$$

It could be observed that the value allocation using the Shapley value met the rationality conditions.

Coalition rationality, which requires that no player would be allocated a value that is greater than it would value to that player alone.

$$\phi_1 = 3214.2 \leq v(\{1\}) = 4383$$

$$\phi_2 = 5262.2 \leq v(\{2\}) = 6999$$

$$\phi_3 = 5893.6 \leq v(\{3\}) = 7283$$

Table 3. Transmission cost allocation (\$/h)

Player	L2	L3	L4	Total
Shapley value	156.57	256.33	287.10	700
MW- Mile	164.36	262.5	273.14	700
Postage stamp	190.90	254.55	254.55	700

It is assumed that customers in the market paid the total transmission cost. Postage stamp method does not consider the physical location and share the total cost among the players versus active

power. In MW-Mile method to determine the cost allocation, the network operator runs a power flow program. Therefore calculates the power flow over each system line and share the cost among the player with linear equation, but equations of power flow is non linear, thus result is approximately.

Despite theses facts, postage stamp and MW- Mile methods are widely implemented because of its simplicity. From the results of Table 3 can be seen, the total cost of transmission system in three methods is equal but in the shapley value method cost allocation between the players is fairly than the postage stamp and MW- Mile method.

## B. Second Case 9 Bus IEEE System

The IEEE 9 bus test system is analyzed to illustrate the proposed technique. The system contains 3 generating units and 3 load points that shown in Figure 2 The system configuration data can be found in [13].

With considering the cost of each line  $C_l = 1000 \times X_l$  (\$/h), total transmission cost is equal 859.5 \$/h. The flow of each transmission line from optimal power flow solution can be calculated that is performed using MATPOWER software [14].

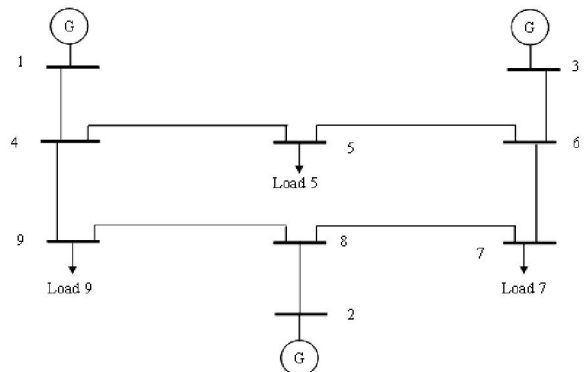


Figure 2. Single-line diagram of the IEEE 9 bus system

Let generators 1, 2, 3 and loads 5, 7, 9 be the players 1, 2, 3, 4, 5 and 6 respectively in the cooperative game  $N = \{1, 2, 3, 4, 5, 6\}$ . Thus there are 63 types of coalition in total. Similar to the calculation process of the first case, we calculate the value of the characteristic function in the case of each coalition. Then, the following results are obtained by using the Shapley Value:

$$\phi_1 = 303282\$, \phi_2 = 490392\$, \phi_3 = 256326\$$$

$$\phi_4 = 290766\$, \phi_5 = 315567\$, \phi_6 = 443667\$$$

It is assumed that generators and customers in the market evenly share the total transmission cost. The results obtained are compared with the traditional

methods adopted to allocate the cost allocation. These are reflected in Table 4 for the 9 bus system.

Table 4. Comparative cost allocations for different methods (\$/h)

Player	$G_3$	$G_2$	$G_1$
Postage stamp	101.21	209.17	119.35
MW- mile	102.73	198.04	128.97
Shapley value	104.91	200.71	124.13
Player	$D_9$	$D_7$	$D_5$
Postage stamp	170.53	136.43	122.81
MW- mile	185.19	132.87	111.7
Shapley value	181.58	129.16	119.01

As can be seen from the results, it is not only the generation or load quantity that decides the cost allocation, but it is also affected by the location of the corresponding player and cost of each line. Thus, this method is capable of providing proper locational signals for the players to locate. As postulated in game theory, it can be proved that no player is paying more than the cost it would have to pay if the system was designed for his individual use.

Also, the contribution from any possible combination is less than the sum of individual contributions. Thus, all players are incentives to stay in the coalition.

### C. Third Case Bilateral Transactions

When the electricity market operates in a deregulated environment then each player is responsible to pay a part of the transmission cost. Similarly to the case of pool market, the form of a coalition between some players can be profitable by the existence of counter flows. Considering the IEEE 9 bus network that shown in Figure 2 and assuming the transactions of Table 5.

Table 5. Transaction Contracts

Transaction	Seller	Buyer	Power (MW)
T1	G1	L5	30
T2	G2	L7	30
T3	G3	L9	45

In the beginning the cost allocation of the entire system is investigated by means of an optimal power flow program. In Table 6 the network usage ( $f_S$ ), as well as the characteristic function value for each coalition, regarding the transaction, are presented.

Table 6. Use and characteristic function value for Coalitions

Coalition	$f_S$ (MW)	$v(S)$ (MW)
T1	64.45	0
T2	72.38	0
T3	135.34	0
T1, T2	125.58	11.25
T1, T3	176.82	22.97
T2, T3	188.93	18.79
T1, T2, T3	234.73	37.44

The savings achieved by the grand coalition {T1, T2, T3} is 37.44 MW that should be shared by the three players. A Shapley value approach to this task is given in Table 7 together with the initial ( $f_i$ )

and final ( $f_i'$ ) network usage for each player. An investigation of the game played at each single system branch may follow. Now,  $f_i$  is the optimal power flow over a system branch caused by player  $i$ . In this case it is possible that some coalitions will have negative values at some branches. Actually, a cooperation between a set of transactions results in a superposition of the single transaction patterns. Thus, in the worst case at a branch for a coalition  $S$  it should be  $v(S) = 0$ . This would happen if no counter flows exist. The explanation for the negative  $v(S)$  is that, since an optimal power flow is used, a generator located at the reference bus must cover the losses. However, when the electricity market is organized according to a bilateral transaction model the cost allocation game can be played at each single system branch.

Table 7. Initial and final use for the Transactions

Transaction	$f_i$ [MW]	$\phi_i$ [MW]	$f_i' = f_i - \phi_i$ [MW]
T1	64.45	11.40	53.05
T2	72.38	10.34	62.04
T3	135.34	15.7	119.64

It is assumed that the contracts in the market paid the transmission cost. The results obtained for transmission cost allocation in different contracts reflected in Table 8.

Table 8. Transmission cost allocations for bilateral transaction (\$/h)

Transaction	T1	T2	T3	Total
Shapley Value	194.25	227.17	438.08	859.5

## 5. Conclusion

The Shapley Value of cooperative game theory is proposed to allocate the transmission fixed cost incurred by the ISO to accommodate all the players while taking physical constraints into account. It offers an alternative solution method based on game theory that can realistically stimulate the practical situation, where the players join together to form a coalition. This method overcomes the difficulty of the conventionally used postage stamp method or MW Mile method by taking the incremental contribution of each player into account, thus encouraging the economically optimal usage of the transmission facilities.

The proposed method with considering active power passing the transmission system provides a stable and unbiased solution to the complex problem of fixed cost allocation in both pool market and the bilateral transaction structure. Thus, it can be seen that in a deregulated environment, where the fixed costs are to be allocated between the players, the game theoretic approaches can be applied in a justified way. These incentives the players to join the coalition at a proper setting to optimize the network cost.

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## Fractional Differential Equations with Fuzzy Order

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**Abstract:** In this paper we introduce fractional differential equations with fuzzy order. Then using Variational iteration method we propose a method for computing approximations of solution of fractional differential equations with fuzzy order.

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**Key words:** Fuzzy number, Fractional derivative, Variational iteration method.

### 1. Introduction

Fractional differential equations have been the focus of many studies. So many attention has been given to the solution of fractional differential equations and a number of literatures concerning the application of fractinal differential equations in nonlinear dynamics has been grown recently [13-15]. Fractional differentials with uncertainty in parameters or initial values, have been the recent study of authors as fuzzy fractional initial value problems [3,6]. Fractional differential equations with uncertainty in the order of fractional derivative will form fractional differential equations with fuzzy order which is introduced in this paper. Fractional differential equations which arise in real-word physical problems are often too complicated to solve exactly. We propose a method for computing approximations of solution of a fractinal differential equations with fuzzy order. The Variational Iteratiion method has been shown [1,2] to solve effectively, easily, and accurately a large class of nonlinear problems with approximations converging rapidly to accurate crisp solutions in crisp problems. Here we use the advantage of this method to find an approximate solution for the fractional differential equations with fuzzy order.

### 2. Preliminaries

Some basic definitions will be considered as follows. Let  $E$  denote the class of fuzzy sets on the real line.

**Definition 2.1.** We write  $A(x)$ , a number in  $[0,1]$ , for the membership function of  $A$  evaluated at  $x$ . For  $0 < \alpha \leq 1$  an  $\alpha$ -cut of  $A$  written  $A_\alpha$  is defined as  $\{x | A(x) \geq \alpha\}$ , also  $A_0$  is defined as the closure of the union of all the  $A_\alpha$ ,  $0 < \alpha \leq 1$ .

The parametric form of a fuzzy number can be defined as follows. According to the representation theorem for

fuzzy numbers or intervals [9], we use  $\alpha$ -cut setting to define a fuzzy number or interval.

**Definition 2.2** [9]. A fuzzy number (or interval)  $u$  is completely determined by any pair  $u = (u_1, u_2)$  of functions  $u_{1,2} : [0,1] \rightarrow R$ , defining the end-points of the  $\alpha$ -cuts, satisfying the three conditions:

- (i)  $u_1 : \alpha \rightarrow u_1(\alpha) \in R$  is a bounded monotonic increasing (non-decreasing) left-continuous function  $\forall \alpha \in (0,1]$  and right-continuous for  $\alpha = 0$ ;
- (ii)  $u_2 : \alpha \rightarrow u_2(\alpha) \in R$  is a bounded monotonic decreasing (non-increasing) left-continuous function  $\forall \alpha \in (0,1]$  and right continuous for  $\alpha = 0$ ;
- (iii)  $u_1(\alpha) \leq u_2(\alpha) \quad \forall \alpha \in [0,1]$ .

If  $u_1(\alpha) < u_2(\alpha)$  we have a fuzzy interval and if  $u_1(\alpha) = u_2(\alpha)$  we have a fuzzy number; for simplicity we refer to fuzzy numbers as intervals.

We will then consider fuzzy numbers of normal and upper semicontinuous form also we assume that the support  $[u_1(\alpha), u_2(\alpha)]$  of  $u$  is compact (closed and bounded). The notation  $u_\alpha = [u_1(\alpha), u_2(\alpha)]$ ,  $\alpha \in [0,1]$  denotes explicitly the  $\alpha$ -cuts of  $u$ .

**Definition 2.3** We say that the fuzzy number  $A = (A_1, A_2)$  is not less than zero, and write

$$A \geq 0 \text{ iff } A_1 \geq 0 \text{ and } A_2 \geq 0.$$

hence for two ordered fuzzy numbers  $A, B$  the relation  $A \geq B$  holds if  $A - B \geq 0$ , which makes  $F$  a partial ordered ring. In the situation when for two numbers  $A, B$  the above inequality holds and, moreover,  $A \neq B$  we will write  $A > B$ . According to the above denotations we can write shortly  $A < \hat{1}$  for the case when  $\hat{1} - A > 0$ .

**Definition 2.4** A mapping  $F: I \rightarrow E$  is strongly measurable if for all  $\alpha$ , ( $0 < \alpha \leq 1$ ),  $F_\alpha(t)$  is Lebesgue measurable for any  $t \in I$ , where  $F_\alpha(t) = [F(t)]^\alpha$ .

**Definition 2.5** A mapping  $F: I \rightarrow E$  is called levelwise continuous at  $t_0 \in I$  if all its  $\alpha$ -levels  $F_\alpha(t) = [F(t)]^\alpha$  are continuous at  $t = t_0$  with respect to the metric  $d$ . And  $F$  is called integrably bounded if there exist an integrable function  $h$  such that  $|x| \leq h(t)$  for all  $x \in [F(t)]^0$ .

We define  $F_\alpha(t) = [F(t)]^\alpha = [F_1(t, \alpha), F_2(t, \alpha)]$  as  $\alpha$ -levels of the mapping  $F: I \rightarrow E$ . A function  $f: I \rightarrow R$  is said to be a measurable selection of  $F_\alpha(t)$  if  $f(t)$  is measurable and

$$F_1(t, \alpha) \leq f(t) \leq F_2(t, \alpha)$$

for all  $t \in I$ .

**Definition 2.6** Let  $F: I \rightarrow E$ . The integral of  $F$  over  $I$  is defined levelwise by the equation

$$[\int_I F(t) dt]^\alpha = \int_I F_\alpha(t) dt = \{ \int_I f(t) dt \mid f: I \rightarrow R \text{ is a measurable selection for } F_\alpha \},$$

for all  $0 < \alpha \leq 1$ .

### 3. Fractional derivative of fuzzy exponent

If  $r \in \mathfrak{R}$ , we use the following fractional derivative and extend it to a kind of fuzzy derivative when  $r \in E$  is a fuzzy number.

**Definition 3.1** Caputo fractional derivative of order  $r$  ( $0 < r < 1$ ) for  $u(t): R \rightarrow R$  is defined as

$$D_c^r u = \frac{1}{\Gamma(1-r)} \int_0^t (t-s)^{-r} \left( \frac{d}{ds} u(s) \right) ds$$

If  $r \in \mathfrak{R}$  then  $\Gamma(r) \in \mathfrak{R}$ , now  $r \in E$  is represented by a pair of continuous functions, say

$$r = (r_1, r_2)$$

then its composition with the Euler function  $\Gamma$  leads to ordered fuzzy number

$$\Gamma(r)(s) = (\Gamma(r_1)(s), \Gamma(r_2)(s)) \quad , \quad s \in [0, 1]$$

which is just a pair of continuous function of  $s$  variable, the composition of real-valued function  $\Gamma$  with an ordered fuzzy number  $r = (r_1, r_2)$  gives the pair  $(\Gamma(r_1)(s), \Gamma(r_2)(s)) \in E$  which is an ordered fuzzy number.

**Definition 3.2** By a fuzzy fractional derivative of order  $r \in E$  of  $y$  we understand a function defined

on  $[0, \infty) = \mathfrak{R}^+$  with its value in  $E$ , i.e. for each  $t \in [0, \infty)$  it is an ordered fuzzy number given by the classical Caputo definition for fractional derivative of order  $r$  of the function  $x(t)$

$$\frac{d^r x(t)}{dt^r} = \frac{1}{\Gamma(n-r)} \int_0^t \frac{x^{(n)}(\tau)}{(t-\tau)^{r+1-n}} d\tau$$

for  $n-1 < r \leq n$ . If  $\alpha = r$  then

$$\frac{d^r x(t)}{dt^r} = x^{(n)}(\tau)$$

here  $x^{(n)}(\tau)$  denotes the  $n$ -order derivative of the function  $x(\tau)$ ,  $\tau \in \mathfrak{R}^+$ .

In preceding definition the inequality  $n-1 < r \leq n$  is understood as a relation in  $E$  between ordered fuzzy numbers:  $n-1$ ,  $\alpha$  and  $n$ , i.e. for each  $s \in [0, 1]$

$n-r_2(s) \geq 0$  and  $r_2(s) - (n-1) > 0$  for the up-part of  $r$ , and  $r_1(s) - (n-1) > 0$  and  $n-r_1(s) \geq 0$  for the down-part of ordered fuzzy number  $r$ , where  $s \in [0, 1]$ . Since for  $\Gamma(r)$  we will have the

representation (7) and for  $x^r = \frac{d^r x(t)}{dt^r}$ , we obtain a

new representation  $(x_1^r, x_2^r)$  as a pair of function of two variables  $t$  and  $s$ , given by

$$x_2^r(t, \alpha) = \frac{1}{\Gamma(n-r_2(\alpha))} \int_0^t \frac{x^{(n)}(\tau)}{(t-\tau)^{r_2(\alpha)+1-n}} d\tau$$

and

$$x_1^r(t, \alpha) = \frac{1}{\Gamma(n-r_1(\alpha))} \int_0^t \frac{x^{(n)}(\tau)}{(t-\tau)^{r_1(\alpha)+1-n}} d\tau.$$

### 4. Differential equation with fuzzy order

Consider the initial value problem with uncertainty in the order of differentiation

$$x^{(r)}(t) = f(t, x(t)) \quad , \quad x(0) = x_0 \quad , \quad x_0, r \in E. \quad (1)$$

Now we transform Eq. (1) to a system of crisp equations as

$$\begin{cases} x_1^r(t, \alpha) = f_1(t, x_1(t, \alpha), x_2(t, \alpha)), \\ x_1(t_0, \alpha) = x_1^{0, \alpha} \\ x_2^r(t, \alpha) = f_2(t, x_1(t, \alpha), x_2(t, \alpha)), \\ x_2(t_0, \alpha) = x_2^{0, \alpha} \end{cases} \quad (2)$$

Each fractional differential equation will be solved with variational iteration method.

To perform variational iteration method, we consider the following general differential equation

$$Lu + Nu = g(t)$$

where  $L$  is a linear operator,  $N$  a nonlinear operator and  $g(t)$  an inhomogeneous or forcing term. According to the variational iteration method, we can construct a correctional functional as follows:

$$u_{n+1}(t) = u_n(t) + \int_0^t \lambda \{Lu_n(s) + N\tilde{u}_n(s) - g(t)\} ds,$$

where  $\lambda$  is a general Lagrange multiplier which can be identified optimally via the variational theory. The subscript  $n$  denotes the  $n^{th}$  approximation and  $\tilde{u}_n$  considered as a restricted variation, i.e.  $\delta\tilde{u}_n = 0$ .

In this paper the nonlinear part ( $Nu$ ), in the Eq. (2) are  $x_1^r(t, \alpha)$  and  $x_2^r(t, \alpha)$ . As such, the corresponding correctional functionals are

$$\left\{ \begin{array}{l} x_{1,n+1}(t, \alpha) = x_{1,n}(t, \alpha) + I^r(\lambda_1 \{x_{1,n}^r(t, \alpha) \\ - f_1(t, x_{1,n}(t, \alpha), x_{2,n}(t, \alpha))\}), \\ x_1(t_0, \alpha) = x_1^{0,\alpha} \\ x_{2,n+1}(t, \alpha) = x_{2,n}(t, \alpha) + I^r(\lambda_2 \{x_{2,n}^r(t, \alpha) \\ - f_2(t, x_{1,n}(t, \alpha), x_{2,n}(t, \alpha))\}), \\ x_2(t_0, \alpha) = x_2^{0,\alpha}. \end{array} \right.$$

Since there exists no derivative with integer order in the foregoing correctional functionals, so there exist no way to obtain the stationary conditions directly from a functional with Riemann-Liouville's fractional integrate. Failing to determine the Lagrange multiplier, in order to identify approximately the multiplier, some approximation must be made. To calculate the approximate Lagrange multiplier, we use two integer values  $k_1 = n-1$  and  $k_2 = n$  to find  $\mu_1$  and  $\mu_2$  respectively. For instance, in the first equation of system (2) we have

$$x_{1,n+1}(t, \alpha) = x_{1,n}(t, \alpha) +$$

$$\int_0^t (\mu_1 \{x_{1,n}^{(k_1)}(t, \alpha) - f_1(t, x_{1,n}(t, \alpha), x_{2,n}(t, \alpha))\}) dt$$

and

$$x_{1,n+1}(t, \alpha) = x_{1,n}(t, \alpha) +$$

$$\int_0^t (\mu_2 \{x_{1,n}^{(k_2)}(t, \alpha) - f_1(t, x_{1,n}(t, \alpha), x_{2,n}(t, \alpha))\}) dt.$$

Finally, we put  $\lambda_1 = \beta_1 \mu_1 + \beta_2 \mu_2$ , where  $\beta_1$  and  $\beta_2$  are weighted factors with  $\beta_1 + \beta_2 = 1$ .

In each case, the system of crisp fractional initial value problems will be solved by variational iteration method. Finally, it must be verified whether the results make  $\alpha$ -levels of a fuzzy number.

## 5. Conclusion

Fractional differential equations with fuzzy order have been introduced. Variational iteration method has been applied to obtain approximate fuzzy solution.

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## Production of Bio-active Bacteriocin from Some Bacterial Isolates and its Biological Use in controlling *Erwinia amylovora*

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**Abstract:** Some bacterial isolates were obtained from soil and plant samples contaminated with such a pathogen *Erwinia amylovora* is a Gram- negative enterobacterium, it is the causative agent of fire blight. The preliminary identification of the enzymes producing isolates indicated that only two of them were classified as members of *Bacillaceae*. These were the isolates *Bacillus mycoida* (B1), *Bacillus cereus* (B2). They were tested, and compared with the previously known isolate *Pontoae agglomerans* (WX112), as biocontrol agents. The three isolates *Bacillus mycoida* (B1), *Bacillus cereus* (B2) and *Pontoae agglomerans* (WX112) were resistible to heat, protease sensitive and producers of active proteins. The three isolates demonstrated superior activity against *E. amylovora* and could be bacteriocin producers. They showed high biocontrol activity. Moreover, the ability of the isolates to produce the extra-cellular inhibitory substances in a liquid culture was examined.

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**Keywords:** Antagonistic bacteria; Pear, biocontrol, *Erwinia amylovora*, Fire blight.

### Introduction

Disease symptoms of *E. amylovora* was described by many investigators (e.g., Aldwinckle and Beer, 1979; Vanneste., 2000; and Wilson and Wisniewski, 1994). Briefly, during moist periods in the bloom season, spurs, blossoms, and twigs may become infected, developing a darker, water-soaked appearance. They turn brown to black and rapidly wilt and die. Infected blossoms frequently are distorted. A tan-yellow bacterial exudate (ooze) often appears where infection occurs.

The economic importance of *E. amylovora* ranks high since it infects approximately 75 different species of plants, all in the family Rosaceae. The hosts for this bacterium include apple,

Blackberry, cotoneaster, crabapple, firethorn (*Pyracantha*), hawthorn, Japanese or flowering quince, mountain-ash, pear, quince, raspberry and serviceberry (Gavrilovi *et al.*, 2005 and Vanneste, 2000). Under relatively dry climatic conditions, the bacterium colonizes flower stigma, and subsequent rain or heavy dew usually facilitates movement to the floral cup (hypanthium), where infection generally occurs (Thomson, 1986). In Europe, the disease was first detected in 1955 in England and since then it has spread to most European countries (Bonn and Van der Zwet, 2000 and Hdyta *et al.*, 2006). In the Czech Republic, fire blight of rosaceous plants was first observed in 1986. In 2005, the disease spread to all fruit-growing areas (Josef and Šillerová, 2005). Fire blight disease, caused by the Gram-negative

enterobacterium *Erwinia amylovora*, is a major constraint to fruit production in many areas of the world (van der Zwet and Beer 1991; Zeller.,2005 and Gavrilovi *et al.*, 2005). It is most commonly initiated by epiphytic populations of *E. amylovora* development on blossoms (Aldwinckle and Beer, 1979); so infection occurs mostly through blossoms and less often through succulent shoots (Vanneste., 2000; and Wilson and Wisniewski, 1994).

The most obvious symptom on pear or apple trees is the scorched appearance of leaves on affected branches (Vannests and Yu., 1996; Wilson and Lindow, 1993). Fire blight is controlled mainly by burning and rooting out of affected tree (Vanneste, 1995). These practices are very costly and can result in substantially reduced fruit production. Therefore, antibiotics have been used against this pathogen in some countries (e.g., Laux and Zeller, 2005). However, antibiotics pose the risk of inducing resistance to antibiotics in bacteria, which are also pathogenic to livestock (Beer *et al.*, 1984; McManus and Jones 1994; Van der Zwet and Beer 1991; Laux and Zeller, 2005). Microbial biocontrol of the blossom blight phase of fire blight has been proposed as an alternative to antibiotics (Beer, 1990). El-Masry *et al.*, (1997) and Hattingh *et al.*, (1986) demonstrated that *E. herbicola* Eh252 could be used for the biocontrol of *E. amylovora*, where *E. hebicola* Eh252 was a non-pathogenic epiphytic bacterium that reduced fire blight incidence when sprayed onto apple blossoms before inoculation with *E. amylovora*.



*Erwinia herbicola* Eh252 was found to produce an antibiotic-like compound that inhibits the growth of *E. amylovora*. Additional applications with other strains, i.e. A506 and C9-1, were made 24 hr after inoculation with *E. amylovora* in 2004 and where the surfactant could breakthrough in 2005 (Thomson 1986; Thomson *et al.*, 1993; Heissenberger *et al.*, 2005 and Wenneker *et al.*, 2005). The objectives of the present study were isolation of *E. amylovora* suppressive bacteria, especially the active strains against this pathogen. Moreover, characterization of the antimicrobial materials obtained from promising isolated bacteria was performed.

## 2. Materials and Methods

### Indicator strain:

An indicator strain of *E. amylovora* was used in this study. The strain was kindly provided by Prof. Hassan Abd-El-Khare, Department of Plant Pathology, National Research Centre, Giza, Egypt.

### Specific media for indicator strain growth:

*E. amylovora* was grown on nutrient agar of composition (g/l distilled water): beef extract, 1.0; yeast extract, 2.0; peptone, 5.0; NaCl, 5.0; agar, 15.0; pH 7-4 and 1.5% (v/v) glycerol. The medium was autoclaved at 121°C for 20 min and *E. amylovora* grown aerobically on nutrient agar slants at 28°C for 36 to 48hrs.

### Micro organisms (bio-control agents):

A previous survey was conducted aiming at isolating possible biocontrol agents against *E. amylovora* from soil and plant parts contaminated with *E. amylovora*. Seventy bacterial samples were collected from Alexandria, Monofia and Gharbia governorates, Egypt. Two of these samples were identified and found to contain promising biocontrol agents based on the following bioassays. *Bacillus mycoida* (B1) was isolated from Gharbia governorate. Biochemical identification was carried out according to Collee *et al.* (1996) at faculty of medicine, Alexandria University. Another isolate identified as *Bacillus cereus* (B2) was also isolated from soil samples from Borg-El-Arab City, Alexandria governorate. This latter was identified using the 16S r RNA gene according to Sambrook *et al.*, (1989). The sequence analysis was performed using DNA BLAST and the DNA nucleotide sequence and submitted into the Gen Bank under the accession No. GU113138 (Kabeil, *et al.*, 2010). A previously identified strain (Kabeil, 2005), identified as *Pantoea agglomerans* WX112, was also used to test its activity against *E. amylovora*.

### Medium for Selection and Purification:

Beef peptone glucose (BPG) medium was used for growing the bacteriocin-producing bacteria and to maintain them for short and long term purpose; it contained per liter of distilled water: 3g beef extract,

5g peptone, and supplemented with 2% glucose; in addition to 2% (v/v) agar. The medium was adjusted to pH 7.2, then autoclaved at 121°C for 20 min without glucose, which was separately autoclaved at 110°C for 10 min. The glucose at 40% concentration was then added to the medium at 2% (v/v).

### Bioassay:

The agar well-cut diffusion technique depended on the diffusion of bacteriocin randomly through the agar layer from circular cup cut out from the agar layer. Four wells were punched out from the deep agar medium using clean sterile cork borer (5 mm in diameter) (Kekessy and Piguet, 1970). The base of each well was sealed with a drop of melted sterile water agar (15g/L). A certain volume (100 µl) of cell free supernatant, filtered through a sterile micro-filter membrane (0.22 µm), was pipetted into each well (El-Masry *et al.*, 1997). The plates were left at room temperature for one hour, and then incubated at 30 °C for 48 h. After the incubation period, clear zone around each well (y) was measured. The square radius of the clear zone around each well ( $y^2$ ) was divided over the square well radii ( $x^2$ ) to obtain an arbitrary unit (AU) for the clear zone. In this method, sterile Petri-dishes were poured with a deep BPG agar medium inoculated with 1% (v/v) of *E. amylovora*.

### Identification of the bacterial strain and Culture:

The selected bacterial isolates were identified according to Bergey's Manual of systematic bacteriology (Holt and Krieg, 1984 and Holt *et al.*, 1986). Morphological examination of individual colonies included colony and cell characterization, gram test, spore, and acid fast staining. Motility was observed microscopically by the hanging drop technique since the young broth cultures of bacterial isolates were examined by using a high-power dry objective reduced illumination, motility was confirmed by using stab method in semi-solid media after 7 days of incubation. Diffusion of growth was recorded as positive result. Cell culture in liquid BPG broth medium was inoculated with 1% (v/v) of 24 hours old culture of the enzyme producer strain. It was then incubated at 30°C overnight in a shaking incubator with agitation at 200 rpm. Bacterial cells were collected by centrifugation at 5000 rpm for 10 min at 4°C.

### Conventional methods for bacterial identification

#### Biochemical testes:

Tryptone broth was used as a basal medium for fermentation test. A phenol red 0.01 % was used as an indicator. Fermentation tubes with 1.0 ml of medium provided with the indicator were prepared and pH was adjusted at 7.5 with NaOH. The medium was sterilized at 121°C for 15 min. One ml sterilized glucose, arabinose, xylose and manitol was transferred

to 10-ml-sterilized-glass tubes and inoculated in duplicate with fresh culture for each of the tested bacterial isolates under sterilized conditions, then incubated at 37°C for 72 hrs. Biochemical and physiological identification were carried out as described in Bergey's Manual of Systematic Bacteriology (Claus and Berkeley, 1986).

#### **Catalase Test:**

one drop of 30% hydrogen peroxide was placed on a slide. One loopful of the fresh bacterial culture for each of the tested isolates was taken by a sterile needle and placed on the drop of hydrogen peroxide. Bubble production indicated positive result (Cowan and Steel, 1974). The test was conducted under sterilized conditions.

#### **Hydrolysis of Starch:**

10g soluble starch in 100 ml distilled water was heated in water bath until dissolved; 20ml of this solution was mixed with 100 ml of melted nutrient agar and poured in the Petri-dish after sterilization. A loopful of fresh bacterial culture was picked up by a sterile needle and stabbed onto the agar plate; after 24 hrs of incubation at 37°C, the plate was flooded with dilute iodine solution according to Cowan and Steel (1974).

#### **Methyl Red Test:**

One ml of fresh culture for each bacterial isolate grown in glucose phosphate medium was aseptically transferred into a test tube. Five drops of methyl red reagent was added and read immediately. Positive tests indicated light red color and negative had yellow (Claus and Berkeley, 1986).

#### **Indole Production Test:**

One loopful fresh bacterial culture (24hrs old) was inoculated in peptone broth and incubated at 37°C for 1-3 days, after incubation, Kovac's solution was added and shaken vigorously for one min. A red color in the reagent layer indicated positive reaction (Cowan and Steel, 1974).

#### **Nitrate Reduction Test:**

The freshly prepared bacterial cultures were inoculated in sterile nitrate broth in tubes and incubated at 37°C for 24 hrs. At the end of incubation 0.1ml of solution (A) was added followed by solution (B) in equal volume (Cheesbrough, 1985). The appearance of pink deep color showed that bacterial isolate reduced nitrate to nitrite.

#### **Voges Proskauer Test (V. P.):**

One ml of fresh bacterial culture was grown in phosphate peptone medium. Then, 0.2 ml of 40% KOH, 0.6 ml of 5% alpha naphthol in absolute ethanol was added. After 10-15 minutes with vigorous shaking bright orange red color developed if acetyl methyl carbinol was present (Cheesbrough, 1985).

#### **Citrate Utilization Test:**

Slope culture of the bacterium isolated from Alexandria with a 1 inch butt of Simmon's citrate agar was inoculated by streaking over surface with a wire needle and incubated at 37°C for up to 3 days (Hugh and Leifson, 1953).

#### **Further characterization of the bacteria:**

##### **Biochemical test using api E20 kit:**

The bacterial strains that proved to have the ability of inhibiting the indicator strain were identified according to standard international methods (Barefoot *et al.*, 1994). Biochemical test and confirmatory tests using api kits (20 and 50 CH) were carried out for identification (Willey *et al.*, 2008).

##### **Identification using 16srDNA amplified by polymerase chain reaction (PCR):**

DNA extraction and PCR amplification of 156srDNA region were isolated from the selected isolates according to Sambrook *et al.* (1989). The 16srDNA was amplified by PCR using primers designed to amplify 1500 bp fragment of the 16srDNA region. The forward primer was 5'AGAGTTTGATCMTGGCTCAG3' and the reverse primer was 5'TACGGYTACCTTGTTACGACTT3'. The PCR mixture consisted of 30 picomoles of each primer, 10 ng of chromosomal DNA, 200 µM dNTPs and 2.5 Units of Taq polymerase in 50 µl of polymerase buffer. The PCR was carried out for 30 cycles in 94 C for 1 min, 55 C for 1 min and 72 C for 2 minutes. After completion, a fraction of the PCR mixture was examined using agarose gel electrophoresis (Ausubel *et al.*, 1999) (Fig 1) and the remnant was purified using QIAquick PCR purification reagents (Qiagen). DNA sequences were obtained using an 3130 X DNA Sequencer (Genetic Analyzer, Applied Biosystems, Hitachi, Japan), BigDye Terminator Cycle Sequencing. The PCR product was sequenced using the same PCR primers. Blast program was used to assess the DNA similarities and multiple sequence alignment. Molecular phylogeny was performed using BioEdit software (Hall, 1999).

##### **DNA Sequencing:**

Automated DNA sequencing based on enzymatic chain terminator technique, developed by Sanger *et al.* (1977), was done using 3130 X DNA Sequencer. The sequencing reaction was performed with four different fluorescent labels identifying the ddNTPs, instead of the radioactive labels. The specific emissions were detected and the data were collected for analysis (Prober *et al.*, 1987 and Freeman *et al.*, 1990). The thermal cycling mixture was as follows: 8 µl of BigDye terminator mix, 6 µl of the sequencing primer (10 pmol) and 6 µl of the

sample (PCR product or plasmid), then the reaction was run in the thermal cycler. The cyclic reaction composed of 1 min at 95 °C, then 49 cycles of 30 sec at 95 °C, 10 sec at 52 °C and 4 min at 60 °C. The products were purified using special column according to the instruction of the manufacturer. The elute were taken and add high dye formamide with (1:1) volume ratio, run at 95 °C for 5 min for denaturation, shock on ice, then the sample become ready for sequencing in 3130 X DNA sequence and analysis.

#### **Purification and characterization of bacteriocin Ammonium sulfate precipitation**

BPG broth medium (250ml) was inoculated with 1% (v/v) of 24 h old culture of the tested bacterium; isolated from Gharbia governorate, then incubated at 30°C for 48 h in a shaking incubator, with agitation at 150 rpm. Bacterial cells were collected by centrifugation at 4,000xg for 10 min at 4°C using high-speed centrifuge (Beckman model JA-20). The cell free supernatant was saturated with 60, 70 and 85% ammonium sulfate. Bacteriocin activity and SDS-PAGE were Determined using the supernatant at 60, 70 and 85% saturation; the precipitate was dissolved in a 25 mM phosphate buffer, and then dialyzed against the same buffer overnight with gentle stirring at 4°C. (Spackman *et al.*, 1958).

#### **Determination of protein by Bradford method**

The protein concentration was determined in cell free supernatant and in the precipitate after dialysis using bovine serum albumin standard according to Bradford (1976).

#### **SDS-PAGE and molecular weight determination**

The purified protein was subjected to SDS-PAGE (Laemmli, 1970). Approximately 2 µg to 10µg of purified protein were analyzed by SDS-PAGE under reducing conditions on pre cast Bio-Rad 4 to 20% Tris-HCl gradient gels, using a Mini PROTEAN II electrophoresis system (Bio-Rad) following the manufacturer's instructions. Bio-Rad SDS-PAGE broad-molecular-weight-range proteins were used as a standard. Each sample was applied to a separate well in the slab gel along with a pre-stained SDS molecular weight marker (14-205 kDa).

### **3. Results and discussion**

#### **Bacterial isolation and identification**

The preliminary identification through morphological, biochemical and physiological tests according to Holt and Krieg (1984) and Claus and Berkeley (1986) indicated their classification as members of *Enterobacteriaceae* and *Bacillaceae*. Using the methodology of Collee *et al.* (1996), a bacterial isolate designated as B1 was motile, short rod, gram negative, positive for tests of catalase,

Nitrate reduction, Methyl red, Casein hydrolysis, Vogas proskauer (Cheesbrough, 1985), Strach hydrolysis, Citrate utilization but negative for lactose, sucrose, indole and urease tests (Table 1). Also, it was non-fermenting for glucose, sucrose, lactose and glycerol. The previous results indicated that the B1 isolate can be identified as a species of the genus *Bacillus*. It is well known that beneficial *Bacillus* antagonize pathogens by producing one or more of a variety of metabolites that induce antibiotics, siderophores and other substances such as cyanide (Marta Pujol *et al.*, 2006). Species of these bacteria are also efficient spermosphere and rhizosphere which may be considered as an added advantage for potential biocontrol agent. (Broggini *et al.*, 2005 and Heissenberger *et al.*, 2005). Eventually, such bacteria suppressed the growth of many important plant pathogens (Jock *et al.*, 2002, Marta Pujol *et al.*, 2006 and Willey *et al.*, 2008). For further characterization, this isolate was subjected to identification to species level using the api 20 E kit as well (Table 2).

#### **Identification using 16s rRNA method**

Confirmatory test based on 16S rRNA phylogeny and the sequencing of 500 bp fragment assigned the isolate as *Bacillus mycoida* (B1) Figures (1, 2).

#### **Production of the antibacterial agent in liquid culture**

Four different agar diffusion tests were conducted to investigate antagonistic effects of *Pantoea agglomerans* strain WX112 against *E. amylovora* under laboratory conditions. The well-cut diffusion technique was used (Gross and Vidaver, 1990; Kekessy and Piguest, 1970) to detect and determine the induction of the antagonistic agent in the liquid culture (Fravel, 1988 and Julien and Lindow, 2001). *P. agglomerans* strain WX112, isolated and identified by Kabeil (2005) was used as a test organism against brown rot disease, since it has a well defined bacteriocin (Kabeil, 2005 and Kabeil *et al.*, 2009 and Heissenberger *et al.*, 2005). Thus, the same tests were carried out using *Bacillus cereus* and *Bacillus mycoida* against *E. amylovora* (Table 3 and Figure 3). Our results are similar to those reported by Hatice and Bora (2004) since our isolates suppressed *E. amylovora* activity using agar well-cut diffusion technique. The isolates were selected and tested for their ability to produce an extra-cellular inhibitory substance in a liquid culture. Thus, the new two isolates showed a positive inhibitory effect when their supernatants were tested against the indicator bacterium *E. amylovora* (Figure 3); we used the previous isolate *P. Agglomerans* for comparison. The three bacterial isolates produced larger and clear inhibition zone demonstrating positive inhibitory effect against the indicator strain *E. amylovora* at

AU =  $2.2 \pm 0.2$ ; AU =  $2.6 \pm 0.2$ ; and AU =  $2.8 \pm 0.2$  for *Bacillus mycoida*, *Bacillus cereus* and *P. Agglomerans*; respectively (Figure 3). El-Goorani *et al.* (1992) and Wenneker *et al.* (2005) also found that the bacterium *P. agglomerans* had a biocontrol activity against *E. amylovora*. From characterization of the antagonistic substance produced by the two new isolates, we found that they are resistible to heat and protease sensitive according to Gross and Vidaver (1990). These two criteria indicated that the previous isolates could be bacteriocin producers (Vidaver, 1983 and Helmy and Pieroni, 2000). Such results agree with Johnson and Stockwell (1998) and Heissenberger *et al.* (2005). Van der Zwet and Beer (1991) and Zeller and Wolf in 1996 indicated that another strain of *P. agglomerans* was also capable of protecting blossoms of *Cotoneaster salicifolius* from fire blight, and Later, Laux *et al.* (2003) and Grondona, and Junge (2005) demonstrated that it was also able to significantly reduce the level of fire blight on apple flowers. Such observations were documented in field experimentation under natural and/or artificial infection conditions (Laux *et al.*, 2003 and Laux and Zeller 2005). Their data corroborate the economic importance of our *P. agglomerans* strain WX11 in the biological control of fire blight disease in Pear and Apple. On the other hand, the use of *Erwinia herbicola* Eh252 in biocontrol of *Erwinia amylovora* was successful, especially because its specific effect; i.e. *E. herbicola* Eh252 is a non-plant-pathogenic epiphytic bacterium that reduces fire blight incidence when sprayed onto apple blossoms before inoculation with *E. amylovora*. It was found that *E. herbicola* Eh252 produces on minimal medium an antibiotic-like compound that inhibit the growth of *E. amylovora* (Hattingh, *et al.*, 1986; El-Masry *et al.*, 1997; Vanneste *et al.*, 1992).

#### Determination of the Molecular weight of bacteriocin

In order to determine whether these substances are related to bacteriocin group, the molecular weight of the purified substances was determined by SDS polyacrylamide gel electrophoresis. Thus, the purified material, after

dialyses was applied to 12% SDS polyacrylamide gel (Laemmli, 1970). The molecular weight of two bands were calculated from the relation between molecular weight of the standard marker and the relative mobility of the targeted bands from the three isolates *B. mycoida*; *B. cereus* and *P. agglomerans*. They were found to be 52,000, 45,000 and 30,000 Daltons, respectively (Figure, 5). These weights confirm their relation to bacteriocin group. In practice, most work on the biological control of bacterial plant diseases has aimed to limit the growth and activity of phytopathogenic bacteria at the plant surface (aerial or subterranean), using strains of bacteria that are antagonistic to the pathogen. For a particular disease, development of a successful biological control agent involves initial selection of a suitable antagonist by laboratory (and small-scale field testing at the further investigations) followed by formulation of an effective strategy of application (including both timing and mode of application) with final large-scale field trials to establish cost-effectiveness of the new control measure under agricultural conditions. In conclusion, the three bacterial isolates extracted herein demonstrated superior activity against *E. amylovora* and could be bacteriocin producers.

The biological control of plant diseases using microorganisms that is antagonistic to plant pathogens. Generally, for a particular disease, the development of a successful biological control agent(s) involves initial selection of a suitable bio-antagonist (by laboratory and small-scale field testing), followed by the formulation of an effective strategy of application, including both timing and method of application with final large-scale field trial(s) to establish the biological and cost-effectiveness of control under agricultural conditions.

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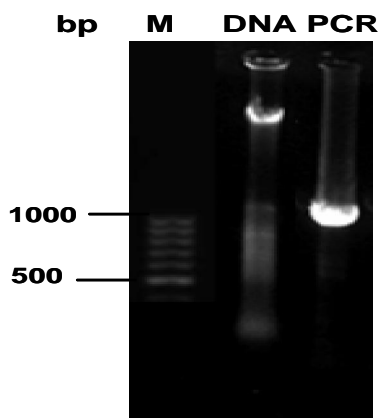
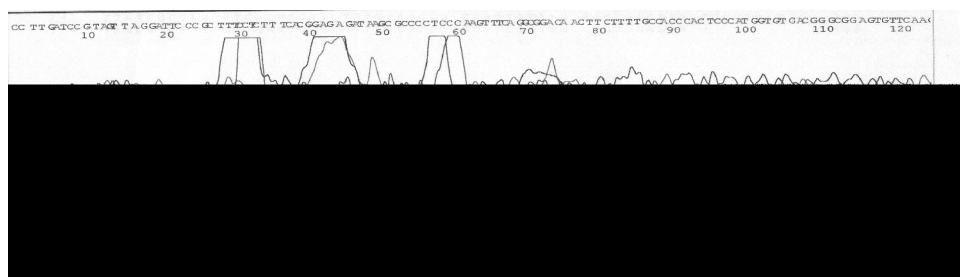
**Table (1): Biochemical characteristics of *Bacillus mycoida*.**

Catalase test	Indole test	Nitrate Reduction test	Urease test	Methy Red test	Lactose fermentation	Oxidase	Sucrose fermentation	Casin Hydrolysis	Vogas Proskauer test	Strach Hydrolysis	Citrate Utilization test
Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Positive	Positive	Positive



**Table (2): Identification of api 20 E kit of *Bacillus mycoida*.**

Tests using API kit	Glucose	Glycerol	Fructose	Maltose	Lactose	Sucrose
<i>Bacillus mycoida</i>	positive	Positive	positive	Positive	Positive	Positive

**Figure 1: Gel electrophoresis of fragment 500 bp of *Bacillus mycoida* (B1)****Figure 2: Sequence of the fragment 500 bp of *Bacillus mycoida* (B1)**

TGCTGCGCACGCCGAGGGGTGATGTGCGAGCGAGTCTCTTCGGAGGCTAGCGGCGGACGGG  
 TGAGTAACACGTAGGCAACCTGCCTCTCAGACTGGGATAACATAGGGAACTTATGCTAA  
 TACCGGATAGGTTTTTGGATCGCATGATCCGAAAAGAAAAGGCGGCTTCGGCTGTCACTG  
 GGAGATGGGCCTGCGGCGCATTAGCTAGTTGGTGGGGTAACGGCCTACCAAGGCGACGAT  
 GCGTAGCCGACCTGAGAGGGTGACCGGCCACACTGGGACTGAGACACGGCCCAGACTCCT  
 ACGGGAGGCAGCAGTAGGGAATTTTCCACAATGGACGAAAGTCTGATGGAGCAACGCCGC  
 GTGAACGATGAAGGTCTTCGATTGTAAAGTTCTGTTGTCAGGGACGAATAAGTACCGTT  
 CGAATAGGGCGGTACCTTGACGGTACCTGTTTTTTTAAGCCACGGCTAACTACGTGCCAG  
 CAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGGATTTATTGGGCGTAAAGCGCGC  
 GCAGGCGGCTATGTAAGTCTGGTGTAAAGCCCGGGGGCTCAACCCCGGTTTCGCATCGG  
 AAATGTGTAGCTTGAAGTGCAGAAGAGGGAAAGCGGTATTCCACGGTGTAGCGGTGAAA  
 TGCGTAGAGATGTGGTAGGAACACCGAGTTGACGAAGGCGCTTTCTGGGTCTGTAACTG  
 ACGCTGAGCGCGAAGCGTGGGAGCAAAACAGGAATAGATACCCTGGTAGTCCGCGCGTAAA  
 CGATGACGTGCTAGGTGTTGCGGGATTCCATAGCATCAGTGTCTGACCTAAGCCATTAGC  
 ACTCGCTGGAATGCCTCGAGAAGTGACTA

**Figure (3): The inhibitory effect of bacterium-produced substance against *Erwinia amylovora* :**  
 (a) *Bacillus mycoida* (b) *Bacillus cereus* (c) *Pantoea agglomerans* strain WX11



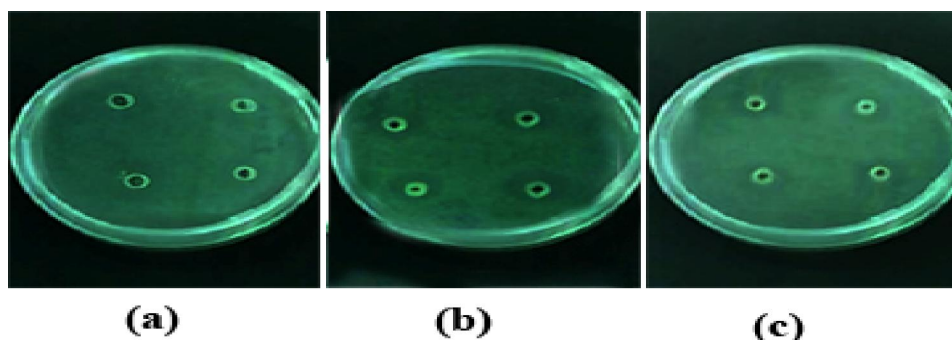
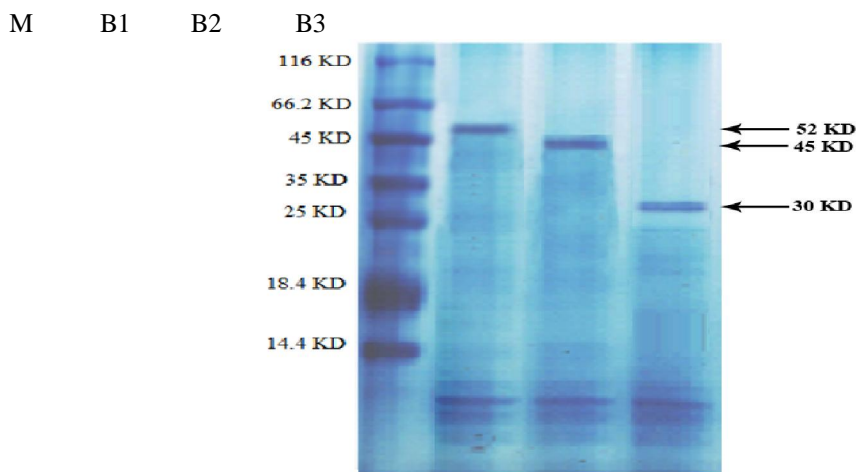


Figure (4): Micrograph of individual bacterial cells of isolate (*Pantoea* sp.) using Scanning electron microscopy (x 10,000 magnification). The cells appeared as short rod bacterium with dimension of 1.2x 0.7  $\mu\text{m}$ . (Kabeil ,2005 ).



Figure (5): SDS-PAGE of the bacteriocin at 85% saturation ammonium sulfate precipitation level. Lane 1, protein pattern M, molecular mass standard Lane 2, protein pattern at 85% saturation ammonium from *Bacillus mycoida* (B1); Lane 3, protein pattern at 85% saturation ammonium from, *Bacillus cereus* (B2) and Lane 4, protein pattern at 85% saturation ammonium from *Pantoea agglomerans* (B3).



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## Prediction of Traditional Climatic Changes Effect on Pomegranate Trees under Desert Conditions in El-maghara, Egypt

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**Abstract:** The main aim of this study is to combat and forecasting climate changes, with some soil managements in El-Maghara Research Station at North Sinai, Egypt, on pomegranate trees. The applied treatments were irrigation intervals and soil mulching with drip irrigation in desert sandy soils and its impact on the water use efficiency and saving of irrigation water. A field experiment was carried out through split plot design during the three seasons 2008, 2009 and 2010 with pomegranate trees have 9 years age, planted at distances 3.6 X 3.6 meters (324 tree/fed). Experiments included 72 test unit consists of three irrigation intervals (2, 4 and 6 days) and three soil mulching practices under the trees (control without mulch, bitumen mulch and olive pomace mulch) and four replicates each have two trees, as the amount of irrigation water was calculated according to Penman - Monteith equation for data the last 10 years of the meteorological data of the region. The results were analyzed statistically which were as follow: (1) There is a detected local climatic change for the main meteorological data of the site compared either with 10 or 30 years recorded data. These changes are partially caused by the global climatic change in one hand and to the local Oasis effect in the site in the other hand. These changes play a positive role in enhancing the yield of pomegranate trees referring to the horticulture references. (2) A significant increase of the values of pomegranate fruit yield, crop water use efficiency, water economy, water saving, total revenue and total profit by increasing of air temperature and humidity of the atmosphere and increasing the irrigation period to 6 days. Olive pomace mulch under the trees, gave higher yield than bitumen mulch, and without mulch. (3) A significant decrease values of water consumptive use, crop coefficient of pomegranate, irrigation water use efficiency coefficient and environmental stress coefficient by increasing the irrigation period to be 6 days. Olive pomace mulching under the trees gave higher yield than bitumen mulch and then without mulch. (4) The highest for the application of economic olive pomace mulch under irrigation with a period of 6 days. In all cases, the applied treatments get higher investment ratios (IR) than the traditional one (2.25 LE/IL). The study recommends with using drip irrigation every 6 days by the amount of irrigation water calculated according to Penman-Monteith equation without addition leaching requirements, with plants residues mulch such as olive pomace under the trees, which gave the highest return of one pound investment with ~ 3.07 LE., taking into account the vulnerability of the study area to the phenomenon of the Continental and Oasis effect, under conditions similar to the study area.

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**Key words:** climate change, irrigation intervals, mulching, pomegranate, water use efficiency, environmental stress coefficient.

### 1. Introduction:

Climatic change is nowadays one of the highly negotiable issues which are not likely to be achieved soon (IPCC, 2007). Mark and Piet Rietveld (2009) stated that the climate change is almost invariably considered an issue of global interest, and therefore also judgments about mitigation and adaptation costs to be made now, differ widely. Supit *et al.*, (2010) stated that the recent changes in the simulated potential crop yield and biomass production caused by changes in the temperature and global radiation patterns are examined, using the Crop Growth Monitoring System. Peter *et al.*, (2005) stated that the oasis self-supporting mechanisms due

to oasis breeze circulation are proposed and simulated numerically. Excessive evaporation from the oasis makes the oasis surface colder than the surrounding desert surface.

Pomegranate trees (*Punica granatum. L*) are widely grown in the warmest area of the Mediterranean basin and Southern Asia. This tree species is well adapted to arid soils, where long periods of soil water deficit are usually present during the dry season. For sustainable water use agriculture, crop-specific and water-saving irrigation techniques that do not negatively affect crop productivity must be developed. Worldwide, successful attempts have been documented regarding the use of water regimes



and mulching techniques to improve water use efficiency in various tree crop species. Thus conserving water is an important aspect for agricultural expansion particularly in arid and semiarid regions where water deficit and high temperature are the main limiting factors for plant growth and productivity. Sheets *et al.*, (2008) reported that the pomegranates are native to grown in ancient Egypt and can be grown in tropical to warm temperate climates. Bakeer (2009) concluded that anti-transpirants of kaolin at 6 % with olive pomace mulching within trees by the regulated deficit irrigation 75 % of crop evapotranspiration showed an increase in water use efficiency to improve vegetative growth, leaf nutrient content, blooming & fruiting, fruit set and yield. While it decrease fruit split, and fruit physical and chemical properties as well as economic revenue of pomegranate trees grown in El-Maghara, Egypt.

Allen *et al.* (1998) stated that mulches are effective in reducing ET of crop and crop coefficient values decrease by an average of 10 – 30 % due to the 50 – 80 % reduction in soil evaporation, but crop growth rates and yield were increased by the use of mulches. Seidhom and Evon (2006) found that a significant increase of fruit yield, water consumptive use, irrigation water use efficiency coefficient, crop coefficient, environmental stress coefficient, water use efficiency, water economy and investment ratio by using black plastic mulch under olive trees followed by gravel mulch, with wider irrigation interval of 6 days, at El-Maghara, Egypt.

Lawand and Patil (1994) and Chopade *et al.*, (2001) observed that the pomegranate fruit yield/tree was greatest at an irrigation water (IW)/cumulative pan evaporation (CPE) of 0.8 with a constant depth of 50 mm. Abou-Aziz *et al.*, (1995) and Afria *et al.*, (1998) recorded that when soil reached 60 or 40% of field capacity, irrigation regime resulted in the highest pomegranate fruit numbers and yields (36.8 and 69.2 kg/tree, respectively, averaged over both years). Prasad *et al.*, (2003) stated that drip irrigation at 8 liters h<sup>-1</sup> day<sup>-1</sup> for 3 h increased the pomegranate yield from 17.7 kg plant<sup>-1</sup> under the control to 28.2 kg plant<sup>-1</sup>. Narendra and Shallendra (2007) reported that the highest yield of pomegranate is (48.46 kg/tree). Shallendra and Narendra (2005) found that 8 liters of water per hour through trickle irrigation gave the highest number of fruits per plant, fruit weight, fruit length, fruit diameter, total soluble solids content, sugar content, pomegranate yield and water use efficiency and the lowest acidity.

Farshi, (2001) found that irrigation water use efficiency (IWUE) in drip irrigation was better than for surface irrigation and WUE of pomegranate

increased from 2.1 kg/m<sup>3</sup> for surface irrigation, to 9.2 kg/m<sup>3</sup> for drip irrigation. Irrigation water savings of 58% were achieved for drip irrigation. Singandhupe *et al.*, (2003) concluded that irrigation at 100% pan evaporation resulted in 18.1% higher pomegranate fruit yield. El-Kassas, *et al.*, (1992) and Gupta *et al.*, (1999) observed that mulching produced the highest pomegranate fruit yields (72.6, 71.9 and 68.2 kg/tree, respectively). Singh *et al.*, (2003) found that mulching reduced fruit cracking of pomegranate, with dried grass or farmyard manure being the most effective and increasing yield. Hasan *et al.*, (2002) stated that the total water consumption and water use efficiency were highest under the highest soil moisture regime with black polythene mulch.

This work is an attempt to clarify the effect of climatic changes on pomegranate trees under irrigation regimes and soil management conditions through mulching treatments and on improving water use efficiency, water economy and productivity of pomegranate grown in sandy soils.

## 2. Materials and methods

This investigation was carried out during the three successive seasons of 2008, 2009 and 2010 to study the effect of climatic changes on yield and water use of pomegranate trees at El-Maghara area under some irrigation intervals (IF): (2, 4 and 6 days) and soil management (SM) conditions through mulching treatments viz: Control Without Mulch (CWM), petroleum as Bitumen Emulsion Mulch (BEM) and plant residues as Olive Pomace Mulch (OPM).

El-Maghara Experimental Station, of the Desert Research Center located in North Sinai Governorate, Egypt (latitude 30.35 N, longitude 33.20 E and 200 meter above sea level). The used climatic data of El-Maghara area were collected from the meteorological station in these station, to calculate reference evapotranspiration (ET<sub>o</sub>) using Penman–Monteith equation by using CROPWAT, software version 5.7 (Smith, 1992). Maximum and minimum air temperature, wind speed, relative humidity, sun shine hours, total rain and reference evapotranspiration are presented in (Table 1).

Seventy two healthy "Manfalouty" pomegranate trees (*Punica granatum. L*) about 9 years – old nearly moderate vigor and productivity planted in sandy soil (mechanical and chemical analyses are shown in Tables 2a,b ) were determined according to Richards (1954). Water of artesian well was pumped from a depth of 288 m in El-Maghara area of Sinai and used for irrigation by drip irrigation system.

**Table (1). Measured climatic data of EL–Maghara region during the period of ten years from 1998-2007.**

Elements	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg.
Max. temp. (°C)	19.15	20.72	22.64	24.81	28.45	32.17	34.08	34.07	30.61	27.82	24.63	21.49	26.72
Min. temp. (°C)	4.54	4.97	7.22	9.87	12.63	15.87	18.25	18.79	15.95	12.84	9.94	6.60	11.46
Relative Humidity %	80.90	77.90	76.44	73.48	75.49	76.35	75.72	76.90	75.84	77.29	77.45	75.80	76.63
Wind speed (km/day)	177.91	184.25	215.02	209.80	192.05	173.45	160.18	165.46	154.85	166.22	173.76	174.07	178.92
Sunshine hours (hr)	7.55	7.98	8.18	9.43	10.79	12.53	12.30	11.31	10.42	9.14	7.71	6.94	9.52
Total Rain (mm)	4.53	5.38	2.11	0.41	0.26	0.00	0.00	0.00	0.00	2.95	7.87	11.51	35.01
Potential evapotranspiration (mm/day)	2.09	2.68	3.51	4.40	5.21	6.06	6.23	5.84	4.79	3.63	2.70	2.24	4.11

**Table (2a). Some physical properties of the experimental soil site.**

Soil depth (cm)	Particle size distribution (%)				Texture class	Particle density (g/cm <sup>3</sup> )	Bulk density (g/cm <sup>3</sup> )	Total porosity (%)	Organic matter (%)	Moisture content (%)		Available soil water %	Infiltration rate	
	Coarse sand	Fine sand	Silt	Clay						Field capacity	Wilting point		cm/hr	Class
0-30	0.00	98.00	1.00	1.00	Sand	2.65	1.55	41.51	0.24	10.23	4.45	5.88	32.65	Very rapid
30-60	0.00	98.50	0.80	0.70	Sand	2.63	1.58	39.92	0.23	9.98	4.51	5.67		
60-90	0.00	99.00	0.50	0.50	Sand	2.64	1.60	39.39	0.19	10.35	4.64	5.65		
90-120	0.00	98.50	0.70	0.80	Sand	2.65	1.57	40.75	0.28	9.87	4.41	5.56		
120-150	0.00	99.50	0.30	0.20	Sand	2.63	1.56	40.68	0.22	10.18	4.39	5.45		

**Table (2b). Some chemical properties of the experimental soil site.**

Soil depth (cm)	CaO <sub>3</sub> (%)	pH soil paste	E.Ce (dSm <sup>-1</sup> )	Soluble cations (me/l)				Soluble anions (me/l)			
				Ca <sup>++</sup>	Mg <sup>++</sup>	Na <sup>+</sup>	K <sup>+</sup>	CO <sub>3</sub> <sup>=</sup>	HCO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>=</sup>	Cl <sup>-</sup>
0-30	5.89	7.70	0.60	2.50	1.50	1.26	0.05	—	1.80	2.11	1.40
30-60	3.80	7.70	0.70	3.00	2.00	1.57	0.08	—	1.80	2.85	2.00
60-90	4.35	7.40	1.10	3.50	2.00	3.04	0.05	—	2.40	2.09	6.10
90-120	5.98	7.60	1.20	3.50	2.50	4.04	0.03	—	3.00	1.97	5.10
120-150	4.44	7.60	0.60	2.50	1.50	1.56	0.03	—	2.40	1.09	2.10

pH: Acidity

E.C.: Electrical conductivity

dSm<sup>-1</sup>: decimenz per meter

me/l: mille equivalent per liter

The quality of tested irrigation water used in this study is presented in (Table, 3). Saline ground water (about 2800 to 3200 ppm) was used for irrigation viz drip system. The analysis of irrigation water belongs to high salinity, medium sodium, i.e.,

C<sub>4</sub>S<sub>2</sub> water class (Richards, 1954). It is also evident that water quality of such source shows a pronounced variation throughout the year being of higher salinity in summer than in winter.

**Table (3). Chemical analysis of the irrigation water.**

Season	pH	E.C.		S.A.R	R.S.C. (me/l)	T.D.S. (ppm)	Units	Soluble cations				Total	Soluble anions				Total	Class
		ppm.	dSm <sub>1</sub>					Ca <sup>++</sup>	Mg <sup>++</sup>	Na <sup>+</sup>	K <sup>+</sup>		CO <sub>3</sub> <sup>=</sup>	HCO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>=</sup>	Cl <sup>-</sup>		
Winter	8.12	2805.14	4.38	9.02	-10.5	2670.91	Ppm.	228.46	42.30	565.80	26.98	863.53	0	268.44	1546.57	126.59	1807.38	C <sub>4</sub> S <sub>2</sub>
							Epm.	11.40	3.48	24.60	0.69	40.17	0	4.40	32.20	3.57	40.17	
							%	28.38	8.66	61.24	1.72	100.0	0	10.95	80.16	8.89	100.0	
Summer	8.36	3194.76	4.99	8.19	-11.7	2967.81	Ppm.	267.13	70.26	582.59	44.97	964.94	0	453.91	1616.69	159.22	2002.86	C <sub>4</sub> S <sub>2</sub>
							Epm.	13.33	5.78	25.33	1.15	45.59	0	7.44	33.66	4.49	45.59	
							%	29.24	12.68	55.56	2.52	100.0	0	16.32	73.83	9.85	100.0	

S.A.R = Sodium adsorption ratio, R.S.C. = Residual sodium carbon, T.D.S. = Total dissolved solids, epm.= equivalent per million

Irrigation treatments were applied from 1<sup>st</sup> February and continued until September 20<sup>th</sup>, then stopped until harvest date October 5<sup>th</sup>, after that completed irrigation until the end of October for three seasons and were programmed according to irrigation

intervals proposed during the afternoon based on calculation of water requirements for irrigation water applied, based on climatic data obtained from the meteorological station of El-Maghara average ten years (1998-2007) table (1).

In the winter (beginning of February), a mulch practice was done by using different materials, such as olive pomace (Table 4a), bitumen emulsion (Table 4b) and control with bare soil (no-mulching). The soil around pomegranate trees were removed by

hand hoeing to the depth of about 15 cm in the beginning of February, then adding olive pomace from olive portion of pulp. While, bitumen emulsion was applied on soil surface around the trunk of pomegranate trees in a circle of 1.5 m half diameter.

**Table 4a. Chemical analysis of olive pomace.**

Organic Mater (%)	C/N Ratio (%)	Moisture (%)	N (%)	P (%)	K (%)	Ca (%)
40.0	11.32	22.6	3.0	0.08	0.47	0.47

**Table 4b. Physical and Chemical Properties of Bitumen Emulsion**

Chemical name(s):	Cationic: KSS60 + 65; Anionic: SS60; Feltec 60/3 + 60/5 KRS60, 65 + 70; KMS 60 + 65; FS60 + 65
pH:	2 to 2.4 - Anionic - Basic nature Cationic - Acid nature
Boiling point/range:	100°C (Contains 40% water)
Melting point/range:	Liquid at ambient temperature
Explosive properties:	Potentially low
Density at 20°C, kg/l	1,0 gm/cm <sup>3</sup> at 25°C
Solubility - water:	Highly soluble
Solubility - solvents:	Soluble
Viscosity	@ 40°C, mm <sup>2</sup> /s: Base bitumen - 2000 AMU
Protonated amine	70 wt. %
Ammonium salt	30 wt. %

All trees received the recommended doses of organic manure in winter, 15-20 m<sup>3</sup>/fed (25 kg/tree) and mineral fertilization of (NPK): 100-200 kg/fed ammonium nitrate in two doses in March and May after the fruit eased, 75 to 100 kg/fed calcium superphosphate and from 50 to 75 kg/fed potassium sulfate in March), respectively.

The amount of irrigation water was calculated without addition leaching requirements using the equation of Doorenbos and Pruitt (1984) and Kaller and Bliesner (1990):

$$D_{iw} = ((ETo \times Kc \times Cr \times No. T.) / Ea) - Pe.$$

Where:  $D_{iw}$  = Applied irrigation water (liter/tree/day)

ETo = Potential evapotranspiration (mm / day)

Kc = Crop coefficient from FAO<sub>56</sub>.

Cr = Canopy cover represented by the shadow area 1.5 m half diameter under trees at mid-day which in average = 7.07 m<sup>2</sup>.

No. T. = No. of trees/fed = 324 tree.

Ea = Irrigation system efficiency (%) = 85 % for drip irrigation.

Pe = Effective rainfall (mm) = 0.30 rainfall.

The amounts of applied irrigation water are shown in table (5).

**Table (5). Irrigation water applied to pomegranate trees grown in El-Maghara area.**

Items	Feb.	Mar.	Apr.	Ma.	Jun.	Jul.	Aug.	Sep.	Oct.	Season
ETo (mm/day) avg.10Years	2.68	3.51	4.40	5.21	6.06	6.23	5.84	4.79	3.63	4.71
Crop coefficient Kc (FAO)	0.4	0.5	0.6	0.7	0.8	0.8	0.8	0.8	0.8	0.69
W.R. (m <sup>3</sup> /fed/day)	2.89	4.73	7.12	9.84	13.07	13.45	12.59	10.33	7.83	9.09
I.R. (m <sup>3</sup> /fed/day)	2.65	4.64	7.10	9.83	13.07	13.45	12.59	10.33	7.71	9.04
Growing Period (days)	28	31	30	31	30	31	31	20	26	258
WR (m <sup>3</sup> /fed/month)	81.02	146.53	213.46	305.10	392.20	416.87	390.25	206.51	203.58	2355.51
I.R. (m <sup>3</sup> /fed/month)	74.24	143.86	212.95	304.78	392.20	416.87	390.25	206.51	200.47	2342.12
WR (liter/tree/day)	8.93	14.59	21.96	30.38	40.35	41.50	38.85	31.87	24.17	28.07
I.R. (liter/tree/day)	8.18	14.32	21.91	30.34	40.35	41.50	38.85	31.87	23.80	27.90
Irrigation Time (hour/day)	0.41	0.72	1.10	1.52	2.02	2.08	1.94	1.59	1.19	1.40

WR: Water requirements, IR: Irrigation requirements, ETo: Potential evapotranspiration, Emitters discharge 20 L/h

Soil moisture was measured with both tensiometer and gravimetric method at depths of 0 -

30, 30 - 60 and 60 - 90 cm. The values of soil moisture content which gravimetrically determined

were employed for calculating the crop water consumptive use using Doorenbos and Pruitt (1984) equation as follows:

$$ETa = (M_2 \% - M_1 \%) \times d_b \times D \times 1000 \quad \text{mm}$$

Where:

ETa = Actual evapotranspiration (mm).

M<sub>2</sub> = Moisture content after irrigation (%).

M<sub>1</sub> = Moisture content before irrigation (%).

d<sub>b</sub> = Bulk density of soil (g / cm<sup>3</sup>)

D = Active root depth (m).

Crop water use efficiency (WUE) was calculated by dividing the crop yield by the amount of seasonal evapotranspiration according to Giriappa, (1983). Water economy was calculated by dividing the crop yield by the amount of water added as kg/m<sup>3</sup> according to Talha *et al.* (1980). Crop coefficient was calculated by dividing the actual evapotranspiration (ETa) by potential evapotranspiration (ETo) according to Yaron *et al.* (1973). Environmental stress coefficient (Ks) was calculated by dividing the actual evapotranspiration (ETa) by maximum crop evapotranspiration (ETc calculated from ETo avg. 10 years and Kc FAO) according to Allen *et al.* (1998). Irrigation water use efficiency coefficient (IWUE) was calculated by dividing the actual evapotranspiration (ETa) by the applied irrigation water (Diw) as reported by Norman *et al.*, (1998). At the end of the experiments, pomegranate yield was recorded. Moreover, in the three seasons, the fruit of each treated trees were harvest on 5<sup>th</sup> October, then fruits were counted and weighed in kg. Data were statistically analyzed using Snedecor and Cochran

(1989). Investment Ratio (IR) = (total revenue, LE / total cost, LE) according to Rana *et al.* (1996).

### 3- Results and Discussion

#### 3.1. Detection of Climatic Changes:

EL–Maghara region, about 90 Km south El-Arish city, North Sinai Governorate, Egypt, with altitude of about 200 meter above sea level, latitude 30°35` N. and longitude 33°20` E. Olive, guava, pomegranate trees and some vegetables, medicinal and aromatic plants are grown in the area.

The climatic change is nowadays one of the highest negotiable issues through either scientific reports or multimedia. Meanwhile, there is no unique vision about this issue as some of scientists believe that changes going toward increasing global temperature, while others referring that to the traditional meteorological cycle of cooling and heating. However, majority of negotiations are dealing with the required precautions in face to the warming phenomenon up to the studied simulation models.

Therefore, meteorological data were collected for a period of 30 years (1961-1990) as well as meteorological data of recent period of 10 years (1998-2007) of the studied area in order to detect the occurrence of changes in the different climatic elements.

Meteorological data for about 30 years (1961-1990) of EL–Maghara region (Table 6a) were collected from the Climatic Atlas of Egypt (1996) and compared with measured climatic data of EL–Maghara region during the ten years period from 1998-2007 (Table 1).

**Table (6a). Meteorological data for about 30 years (1961-1990) of EL–Maghara region.**

Elements avg. 30 years	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
Max. Temperature (°C)	17.5	17.5	22.5	27.5	30.0	32.5	32.5	32.5	32.5	27.5	25.0	20.0	26.46
Min. Temperature (°C)	7.5	7.5	7.5	12.5	15.0	17.5	20.0	22.5	17.5	15.0	12.5	7.5	13.54
Relative Humidity (%)	65.0	60.0	60.0	55.0	50.0	50.0	50.0	60.0	55.0	65.0	60.0	60.0	57.50
Wind speed (km/day)	172.40	176.61	210.24	208.67	185.52	167.47	157.63	163.87	150.00	166.40	173.23	169.52	175.13
Sunshine hours (hr)	7.70	8.20	8.30	9.60	10.90	12.60	12.40	11.40	10.60	9.30	7.80	7.00	9.65
Total Rain (mm)	10.0	10.0	10.0	5.0	1.0	0.0	0.0	0.0	0.0	5.0	10.0	10.0	61.00
Potential evapotranspiration (mm/day)	2.18	2.72	3.89	5.22	6.09	6.70	6.60	6.05	5.40	3.90	3.09	2.45	4.52

Meteorological data for the three studied years (2008, 2009 and 2010) of EL–Maghara region (Table 6b) were summarized as follow:

**Table (6<sub>b</sub>). Meteorological data for 2008, 2009 and 2010 years of EL–Maghara region.**

Elements 2008	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Max. Temperature (°C)	16.60	16.57	21.85	23.17	29.19	35.2	36.33	36.63	33.66	30.64	27.68	21.27	27.40
Min. Temperature (°C)	3.38	4.11	7.17	9.25	13.36	17.97	20.42	20.02	17.17	14.34	10.78	6.86	12.07
Relative Humidity (%)	78.16	77.43	73.22	63.26	66.09	65.26	58.33	62.03	63.34	67.29	73.16	68.31	67.99
Wind speed (km/day)	141.8	173.8	190.6	203.8	140.6	146.2	139.0	168.2	156.0	181.7	140.9	150.70	161.10
Sunshine hours (hr)	7.27	7.72	7.78	9.01	10.25	11.86	11.66	10.67	9.94	8.71	7.31	6.58	9.06
Total Rain (mm)	5.68	10.24	3.21	0	0	0	0	0	0	3.65	4.36	5.20	32.34
Potential evapotranspiration (mm/day)	1.84	2.23	3.29	4.39	5.09	6.34	6.60	6.44	5.35	4.24	2.87	2.28	4.25
Elements 2009	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Max. Temperature (°C)	17.64	17.63	22.93	24.24	30.56	33.55	35.89	36.44	32.56	30.05	28.98	22.32	27.73
Min. Temperature (°C)	4.08	4.87	8.08	10.48	14.73	18.11	20.61	19.78	17.07	14.36	12.89	6.05	12.59
Relative Humidity (%)	78.5	77.22	81.27	73.09	79.16	81.68	77.54	71.08	62.99	67.85	67.46	64.01	73.49
Wind speed (km/day)	202.7	198.2	203.9	245.1	208.9	180.7	164.2	171.5	178.2	155.8	180.2	145.20	186.22
Sunshine hours (hr)	7.20	7.64	7.7	8.92	10.15	11.75	11.54	10.56	9.84	8.62	7.23	6.51	8.97
Total Rain (mm)	3.19	3.04	0	0	0	0	0	0	0	0	0	1.67	7.90
Potential evapotranspiration (mm/day)	2.10	2.39	3.23	4.38	5.29	6.01	6.31	6.22	5.40	3.94	3.31	2.48	4.25
Elements 2010	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Max. Temperature (°C)	18.78	21.15	24.48	25.37	26.89	31.23	34.87	34.88	30.3	29.3	26.11	22.28	27.14
Min. Temperature (°C)	3.83	5.24	8.04	10.13	12.31	15.94	19.6	19.06	15.46	13.71	10.17	7.19	11.72
Relative Humidity (%)	67.63	66.83	68.63	70.33	71.33	72.13	68.63	70.33	64.69	60.92	71.38	68.13	68.41
Wind speed (km/day)	96.34	146.9	271.7	126.8	153.8	135.0	142.1	197.4	128.8	142.9	184.2	241.90	163.99
Sunshine hours (hr)	8.00	8.54	8.67	10.02	11.36	13.12	12.92	11.91	11.06	9.72	8.15	7.30	10.06
Total Rain (mm)	4.28	1.47	0	0	0	0	0	0	0	3.00	6.00	15.00	29.75
Potential evapotranspiration (mm/day)	1.93	2.76	4.26	4.29	5.07	5.91	6.46	6.46	4.92	3.96	3.10	2.87	4.33

To compare the results of average climate values, table (6<sub>c</sub>) shows the results compared to the values of the average climate data of the studied area for a period of 30 years (1961-1990), 13 years (1998-

2010), 10 years (1998-2007), 3 years (2008-2010), and the actual values of years 2008, 2009 and 2010, as the data show the following:

**Table (6<sub>c</sub>) Comparison between meteorological data of the studied three years and both average 10 and 30 years of EL–Maghara area.**

Differences	Comparison with 10 years (1998-2007)				Comparison with 30 years (1961-1990)					
	2008	2009	2010	3 years (2008-2010)	2008	2009	2010	3 years (2008-2010)	10 years (1998-2007)	13 years (1998-2010)
Meteorological elements										
Max. Temperature (°C)	0.68	1.01	0.42	0.70	0.94	1.27	0.68	0.96	0.26	0.42
Min. Temperature (°C)	0.61	1.13	0.26	0.67	-1.47	-0.95	-1.82	-1.41	-2.08	-1.93
Relative Humidity (%)	-8.64	-3.14	-8.22	-6.66	10.49	15.99	10.91	12.46	19.13	17.59
Wind speed (km/day)	-17.81	7.30	-14.93	-8.48	-14.02	11.09	-11.14	-4.69	3.79	1.83
Sunshine hours (hr)	-0.46	-0.55	0.54	-0.16	-0.59	-0.68	0.41	-0.28	-0.13	-0.16
Total Rain (mm/year)	-2.67	-27.11	-5.26	-11.68	-28.66	-53.10	-31.25	-37.67	-25.99	-28.68
Potential evapotranspiration (mm/day)	0.14	0.15	0.22	0.16	-0.27	-0.27	-0.19	-0.24	-0.41	-0.37

To detect the variations in meteorological elements among the three sets of collected data; i.e. 30 years (Table 6<sub>a</sub>), 10 years (Table 1) and the last 3 years (Table 6<sub>b</sub>), the last table show these comparisons. From the table it can conclude to the following:

1. Remarkable increase in average maximum temperature values when comparing the three

years values of 2008, 2009 and 2010 with corresponding ones of both average 10 and 30 years bases which could be contributed to the enhance in growth parameters (Supit *et al.*, 2010).

2. Remarkable decrease in average minimum temperature values for the three years of 2008, 2009 and 2010 only when compared with 30



years, while fluctuated on 10 years base. This is clearly reflected on achieving the needed chilling hour's requirements which help in breaking the dormancy phase (actually ranged between 250 and 400 hours) (Sheets *et al.*, 2008) compared with the reference one which is between 100-200 hours.

3. The net result of 1 and 2 is wider temperature range of fluctuation for the last years 2008-2010 which reflect partial continental phenomena (Stefan *et al.*, 2007).
4. The relative humidity values become higher when compare the last 3 years 2008-2010 with 30 years data; while lower when compare with 10 years values (Peter *et al.*, 2005).
5. Generally, the wind speed values of the last 3 years 2008-2010 tend to be lower than both 10 and 30 years values.
6. Generally, the rainfall of the last 3 years 2008-2010 give lower values on both bases of 10 and 30 years values (IPCC, 2007).
7. The net conclusion of all elements on reference evapotranspiration (ET<sub>o</sub>) values for the last 3 years 2008-2010 give contradictory trends being lower than average 30 years (may be due to higher relative humidity values), while higher than the 10 years values (may be due to lower relative humidity values) (IPCC, 2007).
8. The last two columns in table (6c) define the "Oasis effect" for the experimental site through the following:
  - a- Definite increase in average maximum temperature values (IPCC, 2007).
  - b- Definite decrease in average minimum temperature values, therefore definite wide temperature range (IPCC, 2007).
  - c- Sensible increase in average relative humidity values (IPCC, 2007).
  - d- Clear decrease in average rainfall values (IPCC, 2007).
  - e- Clear decrease in potential evapotranspiration (ET<sub>o</sub>) (IPCC, 2007).

From all these observations it can conclude to sensible climate variations for the site which should

be faced by proper irrigation application which is the main target of this research. Not worthy to mention that the studied area is a typical site for the "Oasis effect" criteria as the cultivated site is surrounded by mountainous heights which cause heat convection to the cultivated core of the area. So, blowing of the wind loaded with high temperature in the waves caused a rise in the values of evapotranspiration at the edges of the region and cold the core of the cultivated areas (Sheets *et al.*, 2008) and (Peter *et al.*, 2005). Furthermore increasing the values of relative humidity and reducing the values of evapotranspiration within the studied region (Supit *et al.*, 2010). Peter *et al.*, (2005) and Stefan *et al.*, (2007) they found that altitude and surrounding by mountains have a large effect on crop evapotranspiration. Therefore, as they conclude, resolution of land use data and digital elevation models would be needed to reliable model irrigation water requirements for larger regions or the entire country of Oman.

On global base, there are climate changes slightly each year, which can forecast an increase in the average air temperature by about 3 degrees Celsius during the next hundred years, which need several efforts to mitigate and adapt to projected climate change. (IPCC, 2007) pointed out to the global climatic change, and further changes are expected regardless of the efforts to reduce global emissions of atmospheric CO<sub>2</sub> which increased from an industrial concentration of 280 to 379 ppm in 2005 (IPCC, 2007).

The product of these variations reflects a definite decrease in both potential and actual evapotranspiration mean values (ET<sub>o</sub> & ET<sub>a</sub>) for the site under the pomegranate trees.

9. From the horticulture point of view, the pomegranate trees enhance production with wider temperature ranges which is clearly noticed in table (6c). Furthermore, it needs sufficient chilling hours through winter season (October – March) which also detected from the recorded meteorological data as shown in table (6b) as previously mentioned in point 2.

**Interrelation among both potential and actual evapotranspiration, crop production and water use efficiency:**  
**Table (6a) Data of average potential evapotranspiration, actual evapotranspiration, pomegranate yield and water use efficiency for the studied three years (2008-2010).**

Growing seasons	2008	2009	2010	Average
Potential Evapotranspiration ET <sub>o</sub> (m <sup>3</sup> /fed)	2887.04	2833.41	2894.46	2871.64
Actual Evapotranspiration ET <sub>a</sub> (m <sup>3</sup> /fed)	1870.46	1911.52	1966.12	1916.03
Fruit Yield (kg/fed)	6227.28	7019.68	7855.35	7034.10
Water Use Efficiency (kg/m <sup>3</sup> )	3.36	3.70	4.02	3.69

The data in table (6a) indicate the following:

- a- Fluctuation of ET<sub>o</sub> average data over the studied years from 2008-2010.

- b- Successive increase in ETa average values indicating definite effect of climate changes, which discussed before, an enhancing the growth of pomegranate trees.
- c- The general results, despite the effect of treatments, in gradual significant increase in pomegranate production over the three years. However the cumulative increase in trees production through 2008 to 2010 reaches about 23%.

### 3.2. Actual Evapotranspiration (ETa):

EL–Maghara area affected by the phenomenon of what is known “Oasis effect” as it surrounded by mountains and dry desert areas as mentioned before.

Data presented in table (7) show a significant decrease in actual evapotranspiration (water consumptive use) with increasing irrigation intervals, but exhibit highly significant decrease in water consumptive use under olive pomace mulch (OPM) for pomegranate trees. The data also show significant interaction between the applied 6 days irrigation interval and olive pomace mulch (OPM) treatment. Water consumptive use of pomegranate increased by progress of the trees age. Table (7) gives the daily actual evapotranspiration values (liter/tree/day) as

detected by field measurements throughout the growth three seasons.

Comparing the values of water consumption under olive pomace mulch and bitumen emulsion mulch shows the following:

- i- Dark color of bitumen emulsion mulch enhance heat reservation under trees canopy, so providing sufficient energy to processes and conditions related to plant growth. These include movement and uptake of soil water and nutrients, chemical and biological reactions, microbial activities, root growth .....etc.
- ii- Evaporation has been highly retarded under olive pomace mulch than that under bitumen emulsion layer as the former can catch moisture than the latter.
- iii- It is also noticed that the control plots suffered from weed growth which consume some of the added water, so the residual for trees decreased than planned amount, thereby plant growth appreciably decreased.

Similar results were obtained by Hasan et al., (2002) who found that the total water consumption and water use efficiency were highest under the highest soil moisture regime with black polythene mulch. Seidhom and Evon (2006) found that, mulching significantly reduce evaporation losses.

Table (7). Actual evapotranspiration (liter/tree/day) of pomegranate grown in El-Maghara region.

I.F.	S. M.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	liter/tree /day	liter/tree /season	m <sup>3</sup> /tree /season	m <sup>3</sup> /fed
2 (days) a	CWM	7.00	10.94	18.38	26.02	34.29	35.32	33.26	27.09	18.86	23.46	6080.01	6.08 a	1969.92
	BEM	6.79	10.48	16.87	25.52	33.94	34.95	32.92	26.81	18.66	22.99	5955.76	5.96 b	1929.67
	OPM	6.50	10.15	16.12	25.10	33.30	34.30	32.30	26.31	18.31	22.49	5824.37	5.82 c	1887.10
4 (days) b	CWM	6.86	10.13	15.77	25.59	33.87	34.88	32.85	26.75	18.63	22.81	5907.48	5.91 a	1914.02
	BEM	6.58	9.83	15.55	24.89	33.31	34.31	32.31	26.31	18.32	22.38	5793.70	5.79 b	1877.16
	OPM	6.36	9.54	15.30	24.39	31.75	32.70	30.80	25.08	17.46	21.49	5565.52	5.57 c	1803.23
6 (days) c	CWM	6.72	9.90	16.04	25.03	33.16	34.15	32.16	26.19	18.24	22.40	5800.34	5.80 a	1879.31
	BEM	6.50	9.76	15.47	24.04	32.06	33.03	31.10	25.33	17.63	21.66	5608.85	5.61 b	1817.27
	OPM	6.22	9.25	14.93	23.54	30.92	31.85	29.99	24.43	17.01	20.90	5413.98	5.41 c	1754.13
<b>Avg.2008</b>		<b>6.61</b>	<b>10.00</b>	<b>16.05</b>	<b>24.90</b>	<b>32.95</b>	<b>33.94</b>	<b>31.97</b>	<b>26.03</b>	<b>18.12</b>	<b>22.29</b>	<b>5772.22</b>	<b>5.77</b>	<b>1870.20</b>
2 (days) a	CWM	7.14	11.36	18.52	26.65	35.35	36.41	34.29	27.93	19.44	24.12	6250.36	6.25 a	2025.12
	BEM	6.93	10.81	17.07	26.09	34.50	35.54	33.47	27.26	18.98	23.40	6062.70	6.06 b	1964.31
	OPM	6.65	10.48	16.26	25.52	33.87	34.88	32.85	26.75	18.63	22.88	5924.97	5.92 c	1919.69
4 (days) b	CWM	6.93	11.17	17.11	26.16	34.22	35.25	33.19	27.03	18.82	23.32	6042.52	6.04 a	1957.78
	BEM	6.72	10.61	15.86	25.59	33.30	34.30	32.30	26.31	18.31	22.59	5851.96	5.85 b	1896.04
	OPM	6.50	10.04	14.69	25.10	32.45	33.42	31.48	25.64	17.85	21.91	5674.49	5.67 c	1838.54
6 (days) c	CWM	6.79	10.96	16.16	25.52	33.65	34.66	32.64	26.59	18.51	22.83	5914.92	5.91 a	1916.43
	BEM	6.65	10.32	15.57	24.96	32.88	33.86	31.89	25.97	18.08	22.24	5761.02	5.76 b	1866.57
	OPM	6.43	9.97	14.98	24.46	32.03	32.99	31.07	25.30	17.61	21.65	5607.47	5.61 c	1816.82
<b>Avg.2009</b>		<b>6.75</b>	<b>10.64</b>	<b>16.25</b>	<b>25.56</b>	<b>33.58</b>	<b>34.59</b>	<b>32.58</b>	<b>26.53</b>	<b>18.47</b>	<b>22.77</b>	<b>5898.94</b>	<b>5.90</b>	<b>1911.26</b>
2 (days) a	CWM	7.35	12.80	18.88	26.94	36.27	37.36	35.18	28.65	19.95	24.82	6432.38	6.43 a	2084.09
	BEM	7.07	12.44	17.85	26.72	35.21	36.26	34.15	27.81	19.36	24.10	6246.57	6.25 b	2023.89
	OPM	6.86	12.16	17.18	26.01	34.43	35.46	33.40	27.20	18.94	23.52	6094.86	6.09 c	1974.73
4 (days) b	CWM	7.07	12.54	17.06	26.87	34.78	35.83	33.74	27.48	19.13	23.83	6178.29	6.18 a	2001.77
	BEM	6.79	12.08	16.75	25.64	34.08	35.10	33.06	26.92	18.74	23.24	6022.97	6.02 b	1951.44
	OPM	6.58	11.69	16.44	25.31	33.16	34.15	32.16	26.20	18.24	22.66	5872.92	5.87 c	1902.83
6 (days) c	CWM	6.96	12.37	17.28	25.65	34.29	35.32	33.26	27.09	18.86	23.45	6078.91	6.08 a	1969.57
	BEM	6.72	11.95	16.62	25.17	33.30	34.30	32.30	26.31	18.31	22.77	5903.08	5.90 b	1912.60
	OPM	6.50	11.45	16.21	24.67	32.66	33.64	31.68	25.80	17.96	22.29	5776.70	5.78 c	1871.65
<b>Avg.2010</b>		<b>6.88</b>	<b>12.16</b>	<b>17.14</b>	<b>25.89</b>	<b>34.24</b>	<b>35.27</b>	<b>33.22</b>	<b>27.05</b>	<b>18.83</b>	<b>23.41</b>	<b>6067.41</b>	<b>6.07</b>	<b>1965.84</b>

(IF): irrigation intervals, (SM): soil management, (CWM): Control Without Mulch, (BEM): Bitumen Emulsion Mulch, (OPM): Olive Pomace Mulch. L.S.D<sub>0.05</sub>: Intervals = 0.052, 0.059 & 0.048 & Mulch = 0.025, 0.026 & 0.022 for 3 seasons, respectively. a, b, c significant differences.

### 3.3. Fruit Pomegranate Yield:

Supit *et al.*, (2010) found that the recent changes in the simulated potential crop yield and biomass production were caused by changes in the temperature and examined global radiation patterns, using the Crop Growth Monitoring System.

It is quite evident from table (8) that the tree yield increased significantly with increasing irrigation intervals. The higher value of tree yield was achieved

by irrigated trees at 6 days, followed by 4 days. While, the interval 2 days recorded the lowest values of tree yield. The results go in line with those reported by Abou-Aziz *et al.*, (1995), Afria *et al.*, (1998) and Sheets *et al.*, (2008) which noticed that when soil reached 60 or 40% of field capacity, irrigation regime were resulted in the highest pomegranate fruit numbers and yields.

**Table (8). Fruit yield of pomegranate crop grown in El-Maghara region.**

Irrigation Intervals	Soil Management	1 st. season (2008)		2 nd. season (2009)		3 rd. season (2010)	
		kg/tree	kg/fed	kg/tree	kg/fed	kg/tree	kg/fed
2 (days) b	CWM	13.81	4475.25 c	15.75	5101.79 c	18.65	6041.59 b
	BEM	15.45	5005.80 b	17.61	5706.61 b	23.64	7658.87 a
	OPM	18.61	6029.64 a	21.96	7115.01 a	25.12	8140.01 a
4 (days) ab	CWM	15.56	5042.25 c	17.74	5748.17 c	18.83	6101.12 b
	BEM	21.05	6820.20 b	24.00	7775.03 b	25.47	8252.44 a
	OPM	22.50	7290.00 a	25.65	8310.60 a	27.23	8820.90 a
6 (days) a	CWM	15.00	4860.00 c	17.10	5540.40 c	19.41	6287.22 b
	BEM	20.92	6778.08 b	23.85	7727.01 b	27.20	8813.81 a
	OPM	30.08	9744.30 a	31.34	10152.54 a	32.66	10582.16 a
L.S.D. <sub>0.05</sub> : Intervals			1346.73		1577.39		1499.34
L.S.D. <sub>0.05</sub> : Mulch			799.66		994.45		995.03

(CWM): Control Without Mulch, (BEM): Bitumen Emulsion Mulch, (OPM): Olive Pomace Mulch & a, b, c significant differences.

In relation to the specific effect of soil management the olive pomace mulched trees showed to be most effective treatments in tree yield, followed by bitumen mulched trees as compared with unmulched trees (control) (table 8). The same results were obtained by Patra *et al.*, (2004) who found that all the mulching treatments resulted in higher yield per hectare compared to the control. The same trend obtained by those Singh *et al.*, (2003), Seidhom and Evon (2006) and Bakeer (2009).

Considering, the interaction effect of irrigation intervals and soil management on yield, data in Table (8) indicate that irrigated at 6 days with olive pomace mulching trees recorded the highest values of tree yield during the three seasons. However, irrigated at 2 days with non-mulching within trees gave the least values in this concern. However, pomegranate fruit yield increased by progress of the trees age.

From table (8) it is clearly noticed the following:

Irrespective to mulching treatments it is clear that yield increases upon increasing irrigation intervals. These findings may be explained by the effect of expanding irrigation period on enhancing root elongation, while mulching accelerate this result which in turn reflected on yield of trees. These findings are mainly due to stimulation of concurrent flow of water and heat and partial aeration, which increase the yield. On the other hand, data show that variation in yield due to alternate bearing and yield improved. These results

are in agreement with findings of Singh *et al.*, (2003), Seidhom and Evon (2006) and Bakeer (2009).

### 3.4. Water Use Efficiency of Pomegranate Crop (W.U.E.):

Data presented in table (9) reveal that the influence of increasing irrigation intervals on WUE is significant differences. Whereas a mulch treatment significantly increases upon applying mulching treatments compared to the control (irrigation interval at 2 days without mulch). The highest value of WUE is associated with irrigation interval at 6 days by using olive pomace mulch were reached 5.55, 5.59 and 5.65 (kg/m<sup>3</sup>) followed by using olive pomace mulch irrigated at 4 days were reached 4.04, 4.52 and 4.64 (kg/m<sup>3</sup>) for the three seasons, respectively. WUE of pomegranate increased by progress of the trees age.

Peter *et al.*, (2005) and Supit *et al.*, (2010) they found two mechanisms to reduce heat and moisture exchange between the oasis and the surrounding desert: (1) the updraft over the desert reduces low-level hot, dry air flowing from the desert into the oasis; and (2) the downdraft increases the atmospheric static stability that reduces the oasis evaporation, and thus increasing WUE. However, olive pomace mulches may be associated with pronounced increases in soil temperature. So, it is suggested that this result activate both water and nutrient consumptions by root of trees which affect

the crop yield. Also, may due to stimulation of concurrent flow of water and heat and partial aeration, which increase the yield. Similar results

were obtained by Hasan et al., (2002) Seidhom and Evon (2006) and Bakeer (2009).

**Table (9). Water use efficiency and water economy of pomegranate crop grown in El-Maghara region.**

Irrigation Intervals	Soil Management	1 st. season (2008)		2 nd. season (2009)		3 rd. season (2010)	
		Water Use Efficiency (kg/m <sup>3</sup> )	Water Economy (kg/m <sup>3</sup> )	Water Use Efficiency (kg/m <sup>3</sup> )	Water Economy (kg/m <sup>3</sup> )	Water Use Efficiency (kg/m <sup>3</sup> )	Water Economy (kg/m <sup>3</sup> )
2 (days) c	CWM	2.27 c	1.90	2.52 c	2.17	2.90 c	2.56
	BEM	2.59 b	2.13	2.90 b	2.42	3.78 b	3.25
	OPM	3.19 a	2.56	3.71 a	3.02	4.12 a	3.46
4 (days) b	CWM	2.63 c	2.14	2.94 c	2.44	3.05 c	2.59
	BEM	3.63 b	2.90	4.10 b	3.30	4.23 b	3.50
	OPM	4.04 a	3.09	4.52 a	3.53	4.64 a	3.74
6 (days) a	CWM c	2.59 c	2.06	2.89 c	2.35	3.19 c	2.67
	BEM b	3.73 b	2.88	4.14 b	3.28	4.61 b	3.74
	OPM a	5.55 a	4.14	5.59 a	4.31	5.65 a	4.49
L.S.D. <sub>0.05</sub> : Intervals		0.135		0.125		0.093	
L.S.D. <sub>0.05</sub> : Mulch		0.105		0.103		0.097	

(CWM): Control Without Mulch, (BEM): Bitumen Emulsion Mulch, (OPM): Olive Pomace Mulch & a, b, c, significant differences.

### 3.5. Water Economy of Pomegranate Crop (W.E.):

Data in table (9) reveal that the same trend of water use efficiency is observed in water economy of pomegranate which increased by increasing irrigation intervals. However, for mulch treatments significant increase compared to the control (irrigation interval at 2 days without mulch). The highest value of W.E. is associated with irrigation interval at 6 days by using olive pomace mulch were reached 4.14, 4.31 and 4.49 (kg/m<sup>3</sup>) followed by using olive pomace mulch irrigated at 4 days were reached 3.09, 3.53 and 3.74 (kg/m<sup>3</sup>) for the three seasons, respectively. W.E. values of Pomegranate increased by progress of the trees age.

These findings may be due to saving the stored soil moisture and also to high yields, thereby high water economy values. Similar results were obtained by Hasan *et al.*, (2002) Seidhom and Evon (2006) and Bakeer (2009).

### 3.6. Irrigation Water Use Efficiency Coefficient (IWUE):

Many indices to assess water use performance have been used and are summarized by Purcell and Currey (2003). These indices describe the conversion of available water resources into crop yield at different stages of plant growth and thus quantify the proportion of productive water use to unproductive losses. In this study irrigation water use efficiency coefficient is computed as the ratio of actual water demand and the applied amount of irrigation water (Norman *et al.*, 1998). Irrigation water use efficiency coefficient (IWUE) of pomegranate trees decreased by increasing intervals between successive irrigation and mulching (Table, 10). Amounts of applied water will be decreased to raise the irrigation water use efficiency (IWUE), which could be considered as water saving parameter as show in table (10).

**Table (10). Irrigation water use efficiency coefficient (IWUE) of pomegranate crop grown in El-Maghara region during the three seasons.**

Growing seasons	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Irrigation water use
Average 2008	0.74	0.69	0.73	0.82	0.82	0.82	0.82	0.82	0.75	0.78
Average 2009	0.76	0.73	0.74	0.84	0.83	0.83	0.84	0.83	0.76	0.80
Average 2010	0.77	0.83	0.78	0.85	0.85	0.85	0.85	0.85	0.78	0.82
Annual average	0.76	0.75	0.75	0.84	0.83	0.83	0.84	0.83	0.76	0.80

Regarding the irrigation water use efficiency coefficient (IWUE), table (10) shows that the obtained values ranged between 0.63 and 0.86 with an average of 0.78 for 1<sup>st</sup>. year, 0.68 and 0.88 with an average of 0.80 for 2<sup>nd</sup>. year and 0.73 and 0.91 with an average of 0.82 for 3<sup>rd</sup>. year. These findings confirm the success of 6 days interval of irrigation

than other two treatments due to low irrigation use efficiency. It is worthy to note that the efficiency of drip irrigation was assumed to have 85 % (Doorenbos and Pruitt, 1984), so adopting expanded irrigation intervals with some mulching surface application is advised to these conditions. Similar findings were

stated by Farshi (2001), Stefan *et al.*, (2007) and Bakeer (2009).

### 3.7. Pomegranate Crop Coefficient (Kc):

Data presented in table (11) reveal that the influence of irrigation intervals on crop coefficient of

**Table (11). Pomegranate crop coefficient (Kc) under El-Maghara conditions during the three seasons.**

Growing seasons	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Kc Season
Average 2008	0.42	0.43	0.52	0.69	0.73	0.73	0.70	0.69	0.60	0.61
Average 2009	0.40	0.47	0.53	0.68	0.79	0.78	0.74	0.70	0.66	0.64
Average 2010	0.35	0.40	0.57	0.72	0.82	0.77	0.73	0.78	0.67	0.65
Annual average	0.39	0.43	0.54	0.70	0.78	0.76	0.72	0.72	0.65	0.63

Adjusting crop coefficient in suitable environmental conditions which could be considered as water saving parameter. These findings may be the decrease actual evapotranspiration due to keeping soil moisture content under mulch and thus decrease crop coefficient. Similar findings were stated by Allen *et al.*, (1998) and Seidhom and Evon (2006).

### 3.8. Environmental Stress Coefficient (Ks):

When cultivating crops in fields, the real crop evapotranspiration may deviate from ET<sub>c</sub> due to non – optimal conditions such as the presence of pests and diseases, soil salinity, low soil fertility, water shortage or water logging. This may result in reducing the evapotranspiration rate below ET<sub>c</sub>. Therefore, under soil water limiting conditions, K<sub>s</sub> < 1, and where there is no soil water stress, K<sub>s</sub> = 1. Likewise, the same trend of crop coefficient of

pomegranate plant progressively increasing was not significant. However, significant decrease resulted by using mulch of olive pomace and bitumen compared to the control (irrigation interval at 2 days without mulch).

pomegranate were observed for environmental stress coefficient which, progressively increased by increasing irrigation intervals with non significant differences and significant decrease with using mulch of bitumen and olive pomace compared to the control (irrigation interval at 2 days without mulch), table (12).

To increase water saving and decrease water loss we must modified the calculated irrigation water amounts formula by multiplying with adjusting K<sub>c</sub> and dividing by environmental stress coefficient (K<sub>s</sub>) and IWUE and or by for all kinds of other stresses and environmental constraints on crop evapotranspiration, then become as;

$$D_{iw} = ((ET_o \times K_c / K_s / IWUE \times Cr \times No. T.) / Ea) - Pe.$$

**Table (12). Environmental stress coefficient (Ks) of pomegranate crop grown in El-Maghara region during the three seasons.**

Growing seasons	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Ks Season
Average 2008	0.87	0.81	0.86	0.96	0.96	0.96	0.97	0.96	0.88	0.92
Average 2009	0.89	0.86	0.87	0.99	0.98	0.98	0.99	0.98	0.90	0.94
Average 2010	0.91	0.98	0.92	1.00	1.00	1.00	1.01	1.00	0.92	0.97
Annual average	0.89	0.88	0.88	0.99	0.98	0.98	0.99	0.98	0.90	0.94

This may be interpreted that due to decreasing actual evapotranspiration, decreased crop coefficient (K<sub>c</sub>), thus decreased (K<sub>s</sub>) and (IWUE) coefficients under these conditions, which could be considered as water saving parameters and suitable environmental conditions. Similar findings were reported by Allen *et al.*, (1998) and Seidhom and Evon (2006).

### 3.9. Economical Assessment:

The values of investment ratio (IR) are illustrated in table (13). Table (13) calculate the investment rate for the applied treatments in the experiment as a rate for investing one pound as it is calculated as following: IR = total revenue / total

cost, LE. However, the modified IR values calculated depend on the modified irrigation water referring to actual evapotranspiration data. Table (13) arranges the resulted IR values for all treatments in ascending order with guidance of the national IR value which is about 2.25 for this area.

From table (13) it can be concluded the following:

- 1- Mulching with olive pomace gives the high values especially under 6 day's irrigation interval (3.07).
- 2- Bitumen emulsion mulch under 6 days irrigation interval give higher IR values regarding to olive pomace mulch under 4 and 2 days irrigation intervals respectively.



3- All treatments give higher IR values than the national one with increasing trend by increasing irrigation interval being  $6 > 4 > 2$  days.

These findings give a group of options which could

be adapted with different conditions in the site. Similar findings were stated by Seidhom and Evon (2006) and Bakeer (2009).

**Table (13). Inputs, outputs items and investment ratio (IR) of pomegranate yield grown in El-Maghara region.**

Items	Soil management	2 days Irrigation Intervals			4 days Irrigation Intervals			6 days Irrigation Intervals		
		CWM	BEM	OPM	CWM	BEM	OPM	CWM	BEM	OPM
List of Inputs	land preparation, LE/fed	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
	Cultivation, LE/fed	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
	Irrigation, LE/fed	942.20	942.20	942.20	942.20	942.20	942.20	942.20	942.20	942.20
	Organic Fertilization, LE/fed	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
	Mineral Fertilization, LE/fed	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
	Mulch, LE/fed	0.00	900.00	1000.00	0.00	900.00	1000.00	0.00	900.00	1000.00
	Weed Control, LE/fed	120.00	30.00	30.00	120.00	30.00	30.00	120.00	30.00	30.00
	Pest Control, LE/fed	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
	Labors Costs, LE/fed	60.00	30.00	30.00	60.00	30.00	30.00	60.00	30.00	30.00
	Machines, LE/fed	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
	Fuel, LE/fed	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
	Harvesting, LE/fed	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Crop Transportation, LE/fed	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Rent (on season), LE/fed	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00	600.00
	<b>Total cost (LE/fed/season)</b>	<b>2572.20</b>	<b>3352.20</b>	<b>3452.20</b>	<b>2572.20</b>	<b>3352.20</b>	<b>3452.20</b>	<b>2572.20</b>	<b>3352.20</b>	<b>3452.20</b>
List of Output	Yield, kg/fed	6041.59	7658.87	8140.01	6101.12	8252.44	8820.90	6287.22	8813.81	10582.16
	Price, LE/kg	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	<b>Total revenue (LE/fed/season)</b>	<b>6041.59</b>	<b>7658.87</b>	<b>8140.01</b>	<b>6101.12</b>	<b>8252.44</b>	<b>8820.90</b>	<b>6287.22</b>	<b>8813.81</b>	<b>10582.16</b>
	<b>Total profit (LE/fed/season)</b>	<b>3469.38</b>	<b>4306.67</b>	<b>4687.81</b>	<b>3528.92</b>	<b>4900.24</b>	<b>5368.70</b>	<b>3715.02</b>	<b>5461.61</b>	<b>7129.96</b>
<b>Investment Ratio (LE/ILE)</b>		<b>2.35</b>	<b>2.28</b>	<b>2.36</b>	<b>2.37</b>	<b>2.46</b>	<b>2.56</b>	<b>2.44</b>	<b>2.63</b>	<b>3.07</b>

(CWM): Control Without Mulch, (BEM): Bitumen Emulsion Mulch, (OPM): Olive Pomace Mulch.  $0.40 \text{ LE/m}^3$  irrigation water

#### 4- Conclusion

From the above mentioned discussion it can be conclude to the following:

1. There is a detected local climatic change for the main meteorological data of the site compared either with 10 or 30 years recorded data. These changes are partially caused by the global climatic change in one hand and to the local Oasis effect in the site in the other hand. These changes play a positive role in enhancing the yield of pomegranate trees referring to the horticulture references.
2. Enlarging the irrigation intervals from 2 to 6 days cause a gradual increase in such yield as it seems to enhance root elongation, so the shoot growth as well.
3. Saving irrigation water could be enhanced by using olive pomace mulch more than that achieved by bitumen emulsion mulch, while both were higher than that of unmulched trees.
4. In all cases, the applied treatment get higher investment ratios (IR) than the traditional one

(2.25 LE/IL), but mulching with olive pomace engaged with 6 days irrigation interval give the highest IR value among all the tested interactions.

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## Effect of Instructional Guideline on Allergic Rhinitis Symptoms

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**Abstract:** Allergic rhinitis has been described as a disease that may appear quite bearable to the non sufferer. However, it is associated with impairments in how patients function physically, emotionally and socially. The aim of this study was to evaluate the effectiveness of instructional guideline on improving allergic rhinitis symptoms. Subjects and methods: A quasi experimental study design, using a purposeful sample of 60 adult patients suffering from allergic rhinitis with the following criteria: perennial rhinitis, their ages ranged between 18-55 years, non smokers and the infected allergic rhinitis were excluded. Setting: The study was carried out at the (E.N.T.) clinic in El Demerdash Teaching Hospital, Ain Shams University. Tools: Three tools were used to collect data, 1) an interviewing questionnaire, include socio-demographic characteristics of the study, assessment of patient's knowledge about the concept of allergic rhinitis and how to prevent it and questionnaire part to assess patients house hold hygiene practices and using of saline nasal lavage, 2) clinical assessment format including 2 parts a) clinical nose examination, b) Lab examination of nasal secretion for eosinophils, 3) instructional guideline leaflet for household hygiene practices and saline nasal lavage. The results of the study revealed positive effect for using topical saline lavage in addition to household hygiene practices in improving signs and symptoms of allergic rhinitis with more improvement with hypertonic saline in group (2). The study recommended the use of topical hypertonic nasal saline lavage in improving of allergic rhinitis symptoms and increase health awareness about the importance of nose hygiene and household hygiene practices.

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**Key words:** Instructional guideline, allergic rhinitis symptoms, saline solution, hygienic practices, smell sense.

### 1. Introduction:

Allergic rhinitis is an inflammation of the nasal passage membranes in which substances that trigger an inflammatory response are called allergens which most commonly are dust mite in perennial allergic rhinitis. The body attempts to rid itself of substances perceived as harmful by releasing chemical mediators that cause inflammatory response that leads to tissue damage (Craven & Hirnle, 2009).

In the developed countries, it is estimated that approximately 30% of the general population suffer from one or more allergic disorders, of which allergic rhinitis is the most common perennial rhinitis, the most often due to allergy to house dust mite. (Cates et al., 2007 and Sheikh et al., 2007)

House dust mites are found in most homes .They are microscopic, eight-legged creatures closely associated with us .It is a cosmopolitan guest in human habitation. It feed on organic detritus such as flakes of shed human skin and flourish in the stable environment of dwellings (Ogg, 2011).

Good household hygiene practices may improve indoor air quality in the domestic environment. Existing literature has shown that home dampness increases indoor mold burden and is

associated with increased allergic symptoms of rhinitis (Zhang et al., 2005; and Tham et al., 2007).

In allergic rhinitis, symptoms may be seasonal, following contact with grass, trees or flowers, pollen or perennial when the patient near animals, such as cats, dogs or horses; near feathers, including pillows, quilts or in a dusty part of house (house dust mite is the allergen), the patient gets a runny or stuffy nose or start to sneeze (Leynaert et al., 2005; and Craven & Hirnle, 2009). Symptoms also include rhinorrhea, nasal congestion, and sneezing are annoying in themselves, but patients also experience non-nasal symptoms that are troublesome, including headache, thirst and disturbed sleep, some adults reported a decrease in productivity and concentration (Thomas and Platts-Mills, 2009).

Allergic rhinitis and asthma very often coexist in the same patients and both diseases impair quality of life. Poorly managed allergic rhinitis may also complicate management of asthma and may be associated with poor asthma outcomes (Togias, 2003 and Philip et al., 2004). In a similar study, Valovirta and Pawnkar (2006) surveyed over 1600 patients with asthma and found that 73% reported symptoms

of allergic rhinitis before they were diagnosed with asthma.

Saline solution is a salt solution it helps reduce congestion and nasal irritation and there is evidence that saline nasal lavage is beneficial in reducing allergen level in the nose and helps clear out pollen and dander, moistening the mucosa and reduce tissue swelling and so treatment of allergic rhinitis symptoms. This may reduce the need for antibiotics in those people prone to sinus infections (Harvey et al., 2007, Saed, 2007, and More, 2011). It is wise to regularly expose blankets and all bedding including pillows to direct sun light 15-20 minutes as the ultraviolet C (UVC) rays kill dust mites and anything living, virus, bacteria and mould spores (Thomas and Platts-Mills, 2009).

Although allergic rhinitis is not life threatening, it is bothersome for affected patients, negatively impacts quality of life, and may impair work place performance (Philip et al., 2004).

### Significance of the problem:

The number of people affected by allergic disease has risen considerably over the last four decades and the major manifestations are allergic rhinitis. It is a global health problem worldwide and its prevalence is increasing (Bousquet, 2002). As reported by the WHO (2009) in Egypt 10% of population suffers from allergic rhinitis. Allergic rhinitis was present in 63% of asthmatic patients (Omar et al., 2005). Accordingly, it was crucial to the nurses to focus more attention to this problem and develop teaching guidelines to prevent and manage allergic rhinitis based on patients' needs.

### Aim of the study

This study aims to evaluate the effectiveness of instructional guideline on improving allergic rhinitis symptoms through:

1-Assessing allergic rhinitis patients knowledge

2-Assessing allergic rhinitis patients house hold hygiene practices and assess using nasal saline lavage (guideline).

3-Clinical nose examination to assess nasal secretion, color of nasal mucosa and nasal septum.

4-Lab investigation of nasal secretions for eosinophils.

5-Assess signs and symptoms of allergic rhinitis patients.

### Research questions

1-Can the instructional guideline lead to improvement of patient's knowledge about allergic rhinitis?

2-Which concentration of [nasal saline lavage (0.9% or 3%) in addition to house-hold hygiene] (guideline) will improve allergic rhinitis symptoms?

3-Is there a relation between loss of smell sense and duration of allergic rhinitis?

### 2. Methodology

**Design:** The research design used was quasi-experimental study.

**Setting:** The study was carried out at the E.N.T. out patients' clinic in El Demerdash Teaching Hospital, Ain Shams University.

**Subjects:** Purposeful sample of seventy adult patients of both sexes with perennial rhinitis which represent 10% from the previously year attended allergic rhinitis cases to the E.N.T out patients clinic by the help of E.N.T physician to choose cases which diagnosed allergic rhinitis without infection, their ages ranged between 18-55 years. This sample was collected over 3 months from beginning of November, 2009 to the end of January, 2010.

**Exclusion criteria:** Smokers and allergic rhinitis with infection.

**Tools:** Three tools were used:

1. A structured interview questionnaire: developed by the researchers based on literature review including 3 main parts:

a) Demographic data such as age, sex, educational level, duration of illness, patient's history, medication used, and signs and symptoms of disease.

b) Assessment of patient's knowledge about allergic rhinitis, causes, management and prevention.

c) Questionnaire part to assess patients house hold hygiene practices and using of saline nasal lavage (we using questionnaire because some items were not easy to be observed by the researchers and it may done at any time during the 24 hrs of the day).

2. Clinical assessment format including 2 parts:

a) Clinical nasal examination including nasal secretion, color of nasal mucosa and nasal septum by specialist in E.N.T.

b) Lab investigation of nasal secretions for eosinophils (which is a white blood cells increased in allergic reactions) by specialist in pathology.

3. An instructional guideline leaflets developed by the researchers based on literature review including:

a) Basic knowledge about allergic rhinitis includes definition of allergic rhinitis, causes, and signs and symptoms of allergic rhinitis.

b) Instructional guideline about importance and how to use saline nasal lavage. The patients were instructed to use 10 ml syringe saline without the



needle for both nasal cavities by the solution 3-4 times daily, squeezed it with moderate force and allow saline come back out through the nose, this for one month.

- Improve household hygiene practices as changing bed linen and pillow case regularly, vacuuming the floor and remove dust or use dry dust mop. Avoid dampness at home, avoid dampness to mattress, and expose bed linen and pillow to sun light 15-20 minutes daily, expose mattresses to sun light every month. Home visit was carried out in the morning during the sun shine to the study subjects to examine adherence to these instructions by visit 5 patients per day for 3 days per week for one month.

#### **Fieldwork:**

##### **Data collection**

Subjects were interviewed by the researchers, after explaining the aim of the study. Consent form was obtained from every patient willing to participate. Those patients were assigned to 2 equally matched groups. Each group contains 35 patients. First group were using isotonic saline solution (0.9%) in addition to household hygiene and the second group were using hypertonic saline solution (3.0%) in addition to household hygiene, while any other medications used to treat allergic rhinitis were stopped to exclude their effects on the study results for a period of 1 month.

Pre assessment phase was done before implementing the guideline to collect pre assessment data and prepare the patients for implementing the guideline. It was carried out during February 2010, in addition to clinical nose examination and nasal secretion swab through predetermined appointment with them by phone calls.

Nasal swabs were taken from the patients (2 times), in addition to clinical nose examination, prior to application of instructional guideline and using of saline solution. Second time swabs were taken after one month from the application of the instructions and using of saline solution.

Technique of nasal swabs which done by physician: It was taken from patient while immobilizing patient's head, insert swab into the nostril to the posterior nares. Left in place for a few seconds, then removed and kept in sterile broth and transmitted quickly to the lab for eosinophils smear.

Implementation phase: It was done from March 1, till March 30, 2010 in which the researchers interviewed the study subjects explain to them the guideline, demonstrate and redemonstrate to them how to use nasal saline lavage and distributed handouts and 3 bottle of saline solution to all of them. The intervention included group discussion of 5-10

participants for 3 days per week, who met with the researcher for at least one hour.

Evaluation phase: to determine which concentration of saline nasal lavage was effective with household hygiene in improving of allergic rhinitis symptom. It was carried out in May, 2010 and included post assessment questionnaire about patient's knowledge and using saline nasal lavage and examining household hygiene practices in addition to clinical nose examination and swab.

#### **Ethical considerations**

Prior to the pilot study, ethical approval was obtained, as well as consent from each participant. They were assured that anonymity and confidentiality would be guaranteed and that they have the right to withdraw from the study at any time without giving any reason. Stop medications that used to treat allergic rhinitis for one month is done under supervision of E.N.T physician.

**Pilot study:** It was done on 10% of the study subjects to evaluate the clarity, feasibility and applicability of the study tools. According to it, some modifications were done.

**Tools validity:** Tools were evaluated for face and content validity by 5 experts in the field of the study.

**N.B. Limitation of the study: a total number of ten patients were not able to attend the evaluation phase, so they were dropped out of the study and the final sample consisted of sixty patients.**

#### **Statistical analysis:**

The collected data were coded and analyzed by the researchers. Non parametric tests were used for comparison between, pre implementation and post implementation of guideline to subjects. Chi-square and t-test were used and p-value less than 0.05 were considered significant.

Scoring system:

For knowledge and practice items a correct response was scored (1) and an incorrect one was scored zero, satisfactory level was considered from 70% and above.

#### **3. Results**

Table (1) elaborates the demographic characteristics of the studied subjects, as 55% of them, their age ranged 18-<30 years, and for gender, 55% of them were females and 45% were males. According to duration of disease for 50% of the patients it was less than 5 years. In addition, 65% of the study subjects were married.

Table (2) displays history of illness among the study subjects. Results clarified that 30% only knew the right diagnosis of the disease from its beginning, while the others considered it a routine common cold, and 15% of them get immunotherapy. As regards family history, 86.7% had a positive family history of allergic rhinitis. As well, 41.7% of the study subjects get sneezing when exposed to cigarette smoking, and 91.7% when getting up from the bed.

Table (3) demonstrates comparison between the two groups of patients as regards socio-demographic characteristics. The results clarified that there were no statistically significant differences between them, so they were comparable groups.

Table (4) shows the distribution of the two groups under study in relation to their satisfactory

level of knowledge. There were highly statistically significant differences between pre and post implementation of the guideline for the two groups.

As seen in table (5), pre and post implementation of guideline for group 1 and 2, there were highly statistically significant improvements in their practices of nasal saline lavage and household hygiene practices with more improvements in group 1.

According to clinical features of allergic rhinitis and nasal smear for eosinophils for group (1) and (2), there were highly statistically significant differences between pre and post implementation of the guideline with more improvements in group 2 (Table 6).

Table (7), indicates that there is no relation between loss of smell sense and duration of disease.

**Table (1):**Socio-demographic characteristics of the study subjects (n=60).

Items	No	%
<b>Age:</b>		
18-	33	55
30-	12	20
40-55	15	25
Mean $\pm$ SD	31.8 $\pm$ 9.4	
<b>Gender:</b>		
Male	27	45
Female	33	55
<b>Duration of disease (in years):</b>		
<5	30	50
5-	15	25
10-20	15	25
Mean $\pm$ SD	7.1 $\pm$ 4.9	
<b>Educational level:</b>		
Illiterate	9	15
Read and write	9	15
Moderate	24	40
High	18	30
<b>Marital status:</b>		
Single	21	35
Married	39	65

**Table (2):**History of illness among the study subjects (n=60).

Items	No	%
- Knowing right diagnosis from the onset of allergic rhinitis	18	30
Drug used:		
- Anti histaminic and decongestant	60	100
- Corticosteroid nasal spray	50	83.3
- Immunotherapy	9	15
Family history: +ve	52	86.7
-ve	8	13.3
Frequent sneezing: (mean manifestation of allergic rhinitis)		
- When exposed to dust	60	100
- When exposed to cigarette smoking	25	41.7
- When exposed to perfume or insecticide odor	15	25
- When getting up from bed	55	91.7

**Table (3):** Comparison between the two groups of patients as regards socio-demographic characteristics

Items	Group I (isotonic saline)		Group 2 (hyper tonic saline)		Test of Sig. & P-value
	No	%	No	%	
Age (in years):					
18-	16	53.3	17	56.7	t=0.04 >0.05 Insig.
30-	7	23.3	5	16.7	
40-55	7	23.3	8	26.7	
X ± SD	32.0±9.8		32.1±10.3		
Gender:					X <sup>2</sup> =0.08 >0.05 Insig.
Male	13	43.3	14	46.7	
Female	17	56.7	16	53.3	
Duration of disease in years:					t=0.11 >0.05 Insig.
>5					
5-	15	50	15	50	
10+	8	26.7	7	23.3	
	7	23.3	8	26.7	
X ± SD	6.9±3.5		7.0±3.5		
Educational level:					X <sup>2</sup> = 0.62 >0.05 Insig.
Illiterate	5	16.7	4	13.3	
Read & write	4	13.3	5	16.7	
Moderate	13	43.3	11	36.7	
High	8	26.7	10	33.3	

**Table (4):** Distribution of the 2 groups of patients under study pre and post application of the guideline in relation to their knowledge

	Group I (n = 30)				Group 2 (n= 30)			
	Satisfactory				Satisfactory			
	Pre		Post		Pre		Post	
	No	%	No	%	No	%	No	%
Definition of allergic rhinitis	4	13.3	25	83.3	5	16.7	29	96.7
Causes	7	23.3	28	93.3	8	26.7	30	100
Signs and symptoms	5	16.7	28	93.3	7	23.3	28	93.3
Importance of saline lavage	4	13.3	30	100	2	6.7	30	100
Relation of dust and nasal allergy	13	43.3	30	100	17	56.7	30	100
Importance of exposure of mattress to sunlight	5	16.7	30	100	4	13.3	30	100
Importance of cleaning of bedding	6	20	30	100	3	10	30	100
X <sup>2</sup>	241.5				257.6			
P	< 0.001				<0.001			
Sig.	HS				HS			

**Table (5):** Nasal saline lavage and house hold hygiene practices stated by the study subject groups (1 & 2), pre and post application of guideline (n=30).

	Group I (n = 30)				Group 2 (n = 30)			
	Pre		Post		Pre		Post	
	(done)		(done)		(done)		(done)	
	No	%	No	%	No	%	No	%
Change bed linen and pillow case regularly	10	33.3	28	93.3	9	30	26	86.7
Vacuum floor or use dry dust mop.	8	26.7	24	80	10	33.3	25	83.3
Avoid dampness at home	5	16.7	27	90	7	23.3	26	86.7
Avoid dampness of mattress	22	73.3	27	90	20	66.7	29	96.7
Expose bed linen and pillow to sunlight 5-20 minutes daily	10	33.3	28	93.3	12	40	27	90
Expose mattress to sun light every month	6	20	15	50	7	23.3	14	46.7
Clean each nostril with 10 ml saline 3-4 times/day for one month	0	0	28	93.3	0	0	27	90
X <sup>2</sup>	130.6				115.4			
P-value	< 0.001				<0.001			
Sig.	HS				HS			

**Table (6): Clinical features of allergic rhinitis among the study subjects pre/post application of the guideline.**

	Group 1 (n = 30) on saline nasal lavage 0.9%					Group 2 (n=30) on saline nasal lavage 3%				
Items	Pre		Post		X <sup>2</sup> P-value & Sig	Pre		Post		X <sup>2</sup> P-value & Sig
	No	%	No	%		No	%	No	%	
<b>Symptoms</b>										
Rhinorrhea	30	100	7	23.3	37.4 <0.001 HS	30	100	3	10	49.2 <0.001 HS
Itchy nose	30	100	7	23.3	37.4 <0.001 HS	30	100	3	10	49.2 <0.001 HS
Itchy eyes	12	40	6	20.0	2.9 >0.05 Insig.	13	43.3	4	13.3	6.7 <0.05 S
Frequent sneezing	25	83.3	7	23.3	21.8 <0.001 HS	26	86.7	4	13.3	32.4 <0.001 HS
Disturbed sleep	15	50	0.0	0.0	20 <0.001 HS	12	40	0	0	15 <0.001 HS
Loss of smell sense	18	60	0.0	0.0	25.7 <0.001 HS	20	66.7	0	0	30 <0.001 HS
Posterior nasal discharge	30	100	15	50.0	20 <0.001 HS	28	93.3	10	33.3	23.3 <0.001 S
Frequent sick leave	18	60	2	6.7	19.2 <0.001 HS	15	50	0	0	20 <0.001 HS
Headache	25	83.3	6	20	24.1 <0.001 HS	26	86.7	4	13.3	32.4 <0.001 HS
<b>Clinical signs:</b>										
<b>Discharge</b>										
* Watery	30	100	7	23.3	37.4 <0.001 HS	30	100	3	10	49.2 <0.001 HS
* No discharge	-	-	23	76.7		-	-	27	90	
<b>Color of mucosa</b>										
* Violet bluish	30	100	10	33.3	30.0 <0.001 HS	30	100	4	13.3	45.9 <0.001 HS
* Pink	-	-	20	66.7		-	-	26	86.7	
Positive nasal smear for eosinophils	27	90	6	20	29.7 <0.001 HS	28	93.3	3	10	41.8 <0.001 HS

**Table (7): Relation between stated loss of smell sense by study subjects and duration of allergic rhinitis**

Duration of Disease (in years)	Loss of Smell Sense				X <sup>2</sup> P-value Sig.
	Yes		No		
	No	%	No	%	
< 5	10	16.7	20	33.3	2.9 >0.05 NS
5-	2	3.3	13	21.7	
10-20	6	10	9	15	

#### 4. Discussion

Allergic rhinitis is a common health problem for which many patients do not seek appropriate medical care (*WHO, 2009*). The present study revealed that one quarter of the study subjects had duration of disease from 10-20 years. This is to some extent in agreement with the Allergy U.K. survey (2005) of 1000 people, which revealed that 90% of people surveyed had the condition of allergic rhinitis for over 10 years, also these findings are in accordance with *McIlnnis (2010)*, who in a very recent study mentioned that, allergic rhinitis is a long term and often life long condition.

The study results revealed that all the study subjects were perennial allergic rhinitis and it affects both sexes by nearly equal percent, slightly more than two fifths get sneezing when exposed to cigarette smoke and most of them when getting up from the bed. This finding is consistent with *McIlnnis (2010)*, who stated that perennial allergies cause symptoms continuously throughout the year due to constant allergen exposure. Household allergens are typically the causative agents of perennial allergies and include such things as house dust mites, mold spores, cigarette smoke, and pet dander.

Most of the study subjects don't know the actual diagnosis from the onset of allergic rhinitis and consider it a recurrence of routine common cold. This finding contradicted with *Kumar and Clark (2005)*, who ensured that colds are frequent during the winter but if the symptoms persist for weeks the patient is probably suffering from perennial rhinitis.

As regards the study subjects knowledge about the concept of allergic rhinitis and how to prevent and control it, there was a highly statistically significant difference between pre and post implementation of the guideline for the 2 groups (1) this finding answers the research question one. This result is congruent with that of *Mohamed et al. (2006)*, who found that the improvement in

knowledge of their study subjects led to positive effect on controlling their psychological stressors.

Regarding to practices of nasal saline lavage and house hold hygiene practices, the current study results revealed a highly statistically significant difference between pre and post implementation of the guideline for the 2 groups with more improvement in group (1), on isotonic nasal saline lavage. This could be due to that the patients become exhausted from the symptoms and have the desire to overcome this problem.

According to clinical features of allergic rhinitis and nasal smear for eosinophils, there was a highly statistically significant difference between pre and post applying of the guideline for the 2 groups with more improvement in group (2) on hypertonic saline. This finding answers the research question (2), which implies that hypertonic saline had better effect than isotonic saline, in addition to household hygiene practices. This finding is congruent with *Clark (2008)*, who emphasized that, in recent years, greater attention has been given to the health risks posed by environmental conditions. According to the *WHO (2009)* report, approximately 25 to 30% of the global burden of disease is due to environmental exposure. The report also added that household hygiene practices that are low cost activities can be quite effective in keeping persons healthy. In accordance, *Custovic and Vanwijk (2005)*, mentioned that, avoidance of allergen exposure should lead to an improvement in the patients clinical condition. This also agreed with *Shoseyov et al. (1998)*, who found that hypertonic saline is an efficient treatment of chronic sinusitis.

Approximately half of the study subjects were suffering from disturbed sleep pre implementation of the guideline which improved post implementation. This agree with *Mann (2011)* who mentioned that sleep is an important as what we eat, lack of sleep can lead to excessive day time



sleepiness, tiredness and lethargy, morning headache, poor memory, anxiety and depression subsequently affect quality of life.

Concerning the research question (3), there was no relation between loss of smell sense and duration of suffering from allergic rhinitis. This result gives attention to take the problem seriously and ask about proper management from its beginning because loss of smell sense is a problem that affects quality of life as mentioned by the patients that it affected also taste and smell on eating, and make problems with spouse as more than half of the subjects were married and also can lead to life threatening situations in home as they can not smell oven gas as mentioned by the study subjects which return after using of the instructional guideline.

## 5. Conclusion

There was a positive effect of daily nasal lavage with hypertonic saline and improved household hygiene practices in improving and preventing nasal symptoms of allergic rhinitis.

## Recommendations

- The use of topical hypertonic saline could be included as an adjunct to the medical management for the symptoms of allergic rhinitis.
- National program to be launched through mass media for public awareness about concept of allergic rhinitis, and how to prevent and manage it.
- Increase health awareness about the importance of nose hygiene and household hygiene practices.

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## Nuclear Research Reactors Accidents Pattern Recognition Using Artificial Neural Networks

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**Abstract:** The patterns recognition of measured quantities for the diagnostic purposes in the field of nuclear research reactors is very important. It represents one of the fundamental tasks for the operation and accidents management. In this paper, the Nuclear Research Reactors accident's pattern recognition is tackled within neural network approach. Such patterns are introduced initially without noise. The simulated output values of the matrix's diagonal are larger than 0.9, (approximately equal 1), this means the outputs is approximately equal the targets and the network is well trained. To increase the reliability of such neural network, the noise ratio up to 50% was added for training in order to ensure the recognition of these patterns if it introduced with noise. Also, because of the limited amount of data (patterns), this work has taken care to increase the size of these data (patterns) when it introduced as training packages, by adding different random noise ratios as different sets at different times to ensure proper training of the neural network components. The neural network has been tested after training, and also finally tested by providing separate data patterns to ensure the ability of the constructed network to recognize these patterns. Experiments have shown excellent results; where the network did not make any errors for input vectors (patterns) with the noise level from 0.00 up to 0.14. When the noise level is larger than 0.15 was added to the input vectors (patterns) both networks began making errors.

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### 1. Introduction

As a basic definition, a neural network is an assembly of interconnected processing elements used to represent a real world system, i.e. a neural network is an interconnected web of individual neurons. In simpler terms, a neural network is a mathematical system used to approximate a system output based on a specific input. Or, it is a massively parallel distributed processor made up of simple processing units, which has a natural propensity for storing experiential knowledge and making it available for use [6].

Matlab's Neural Network Toolbox is software that provides comprehensive support for many proven network paradigms, as well as graphical user interfaces (GUIs) that enable to design and manage neural networks. The Toolbox supports both

supervised and unsupervised neural networks. The supervised neural networks are trained to produce desired outputs in response to sample inputs, making them, particularly well suited to modeling and controlling dynamic systems, recognizing noisy data, and predicting a future event, which is our domain, demand [5-8].

In this work, a neural network is designed and trained to recognize the 9 accidents of the nuclear reactors. By the aid of reactor operation crew and Safety Analysis Report (SAR) of the reactor, also the Atomic Energy Authority (AEA) experts, data sets were collected for the eight accidental cases listed below plus the normal operation case (Classes) as shown in Figure (1). So the total cases, which we have, are nine. The result is that each accident is represented as a 3-by-5 grid of Boolean values.

TR0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
TR1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
TR2	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1
TR3	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1
TR4	1	1	1	1	1	1	1	0	0	1	0	0	1	1	1
TR5	0	0	0	0	1	1	1	0	0	0	1	0	1	1	1
TR6	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
TR7	1	1	0	0	1	1	1	1	1	1	1	0	0	0	0
TR8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Figure (1): Sample of reactor accidents data patterns.

However, the data sets perhaps are not perfect, and the accidents can suffer from noise. Perfect recognition of ideal input vectors is required and reasonably accurate recognition of noisy vectors, see Figure (2).

The nine 15-element input vectors are defined in the function *accmodels* as a matrix of input vectors called *accidents*. The target vectors are also defined in this file with a variable called, *targets*. Each input

vector is a 15-element vector (3-by-5), Figure (3), with a 1 in the position of the accident it represents, and 0's everywhere else. For example, the TR0 is to be represented by a 1 in the first element (as TR0 is the first accident of the accidents), and 0's in elements two through fifteen.

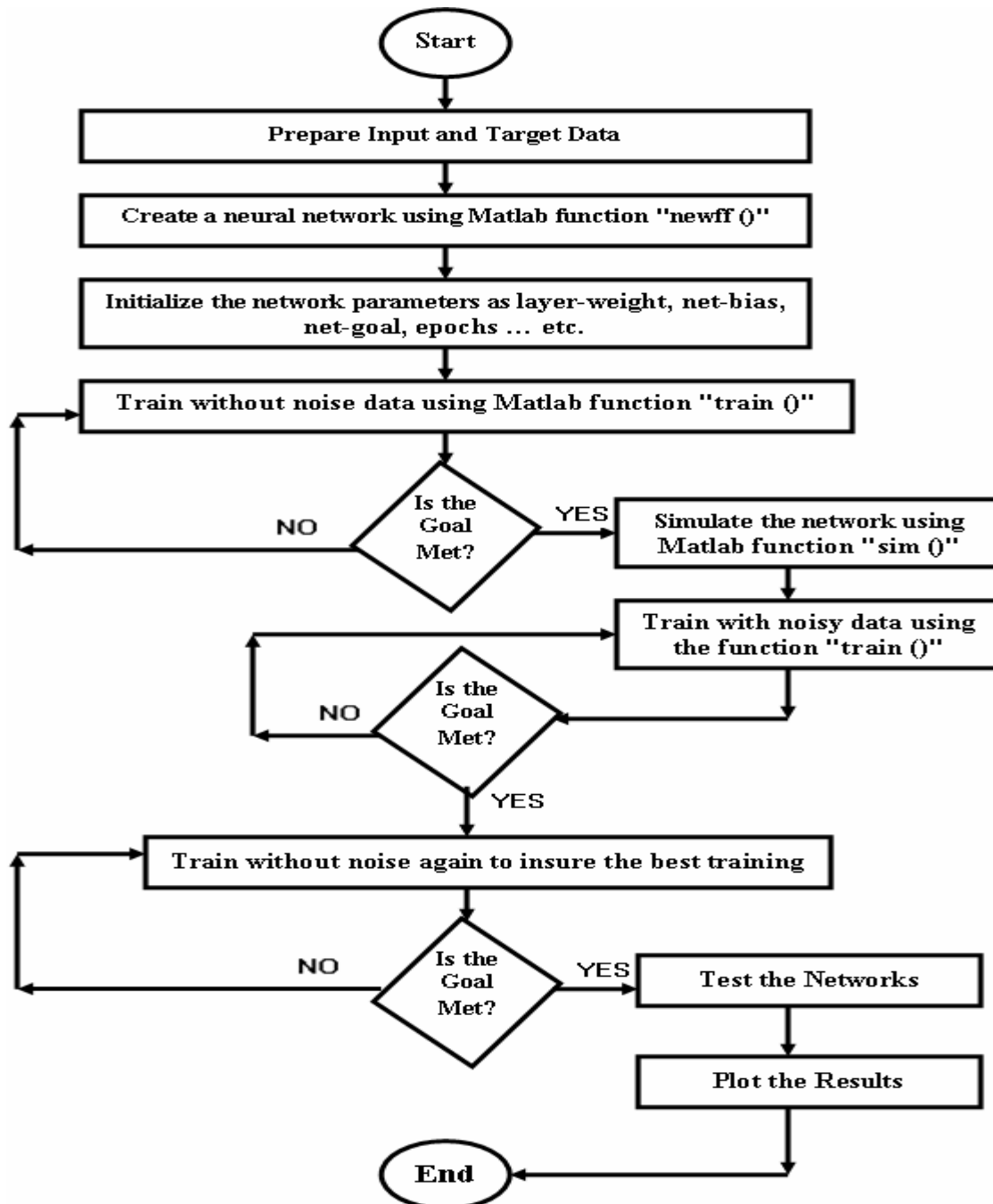


Figure (2): Program flowchart using Matlab.

$TR0 = \begin{bmatrix} 0 & 0 & 0 & \dots \\ 0 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \end{bmatrix};$ 
 $TR8 = \begin{bmatrix} 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \\ 1 & 1 & 1 & \dots \end{bmatrix};$

Figure (3): Samples of (15x9) matrix of (3x5) bit maps for each Accident.

This paper comprises five sections. After this introductory section, Neural Network Implementation is in section (2). Results and Discussions are in section (3). Conclusion is in section (4). Finally, References are in section (5).

## 2. Neural Network Implementation

The network receives the 15 Boolean values as a 15-element input vector (3-by-5). It is then required to identify the accident by responding with a 9-element output vector. The 9 elements of the output vector each represent an accident.

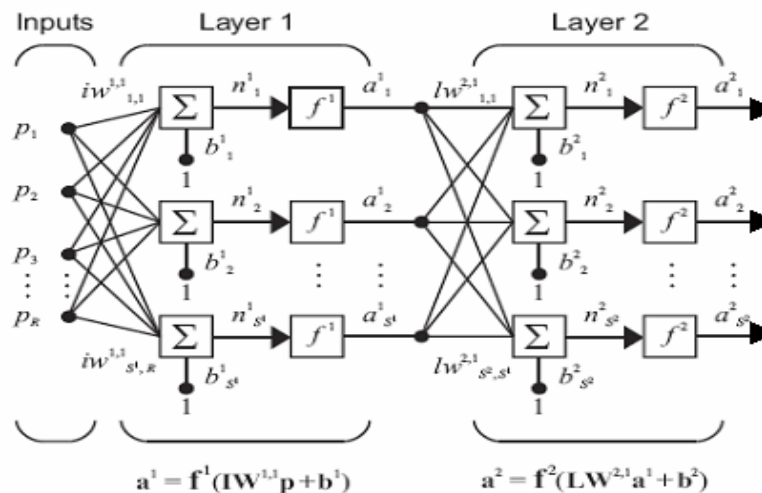


Figure (4): neural network design for accidents patterns recognition

$a^2 = f^2(LW^{2,1}(f^1(LW^{1,1}p + b^1) + b^2) = y_j, \dots (1)$

where: j is neurons in the output layer,

The hidden (first) layer has 10 neurons. This number was picked by guesswork and experience. If the network has trouble learning, then neurons can be added to this layer, Figure (4).

The network is trained to output a 1 in the correct position of the output vector and to fill the rest of the output vector with 0's. However, noisy input vectors can result in the network's not creating perfect 1's and 0's. After the network is trained the output is passed through the competitive transfer function *compet*. This makes sure that the output corresponding to the accident most like the noisy input vector takes on

To operate correctly, the network should respond with a 1 in the position of the accident being presented to the network. All other values in the output vector should be 0.

In addition, the network should be able to handle noise. In practice, the network does not receive a perfect Boolean vector as input. Specifically, the network should make as few mistakes as possible when recognizing vectors with noise of mean 0 and standard deviation of 0.2 or less.

### 2.1 Network Architecture

The neural network needs 15 inputs and 9 neurons in its output layer to identify the accidents. The network is a two-layer log-sigmoid/log-sigmoid network. The log-sigmoid transfer function was picked because its output range (0 to 1) is perfect for learning to output Boolean values.

a value of 1, and all others have a value of 0. The result of this post-processing is the output that is actually used.

### 2.2 Network Training

To create a network that can handle noisy input vectors, it is best to train the network on both ideal and noisy vectors. To do this, the network is first trained on ideal vectors until it has a low sum squared error. Then the network is trained on 10 sets of ideal and noisy vectors. The network is trained on two copies of the noise-free accidents at the same time as it is trained on noisy vectors. The two copies of the noise-free accidents are used to maintain the network's ability to recognize ideal input vectors.



Unfortunately, after the training described above the network might have learned to recognize some difficult noisy vectors at the expense of properly recognizing a noise-free vector. Therefore, the network is again trained on just ideal vectors. This ensures that the network respond perfectly when presented with an ideal accident. All training is done using backpropagation with both adaptive learning rate and momentum, with the function 'traingdx'. The Error (Performance) is calculated in terms of Sum-Squared Error (SSE), equation (2), or Mean-Squared Error (MSE), equation (3), according to the choice of the performance function at the network creation by the following two equations:

$$SSE = \sum_{i=1}^N \sum_{k=1}^K (t_{i,k} - y_{i,k})^2 \quad \text{--- (2)}$$

$$MSE = \frac{1}{N \cdot K} \sum_{i=1}^N \sum_{k=1}^K (t_{i,k} - y_{i,k})^2 \quad \text{--- (3)}$$

Where  $N$  and  $K$  denote the number of patterns and output nodes used in the training respectively,  $i$  denotes the index of the input pattern (vector),  $k$  denotes the index of the output node,  $t_{i,k}$  and  $y_{i,k}$  express the desired output (target) and actual output values of the  $k^{\text{th}}$  output

```
traingdx-calgrad, Epoch 0/5000, SSE 19.9605/0.01, Gradient 8.02798/1e-006
traingdx-calgrad, Epoch 20/5000, SSE 10.6245/0.01, Gradient 3.34315/1e-006
traingdx-calgrad, Epoch 40/5000, SSE 7.82391/0.01, Gradient 0.770611/1e-006
traingdx-calgrad, Epoch 60/5000, SSE 7.32363/0.01, Gradient 0.701802/1e-006
traingdx-calgrad, Epoch 80/5000, SSE 6.0438/0.01, Gradient 0.673944/1e-006
traingdx-calgrad, Epoch 100/5000, SSE 3.62131/0.01, Gradient 0.528835/1e-006
traingdx-calgrad, Epoch 120/5000, SSE 1.02062/0.01, Gradient 0.29785/1e-006
traingdx-calgrad, Epoch 140/5000, SSE 0.0620723/0.01, Gradient 0.0339726/1e-006
traingdx-calgrad, Epoch 158/5000, SSE 0.00994019/0.01, Gradient 0.0062113/1e-006
traingdx, Performance goal met.
```

Figure (5): neural network training output

Figure (6) show the plot of performance vs. number of epochs. Figure (7) show the network response simulation. Figure (7-a) show a 9x9 simulation output matrix's diagonal values that

node at  $i^{\text{th}}$  input pattern, respectively. The calculation of the output is according to figure (4) for two layers network using equation (1).

### 2.2.1 Training without Noise

The network is initially trained without noise for a maximum of 5000 epochs or until the network sum squared error falls beneath 0.1. Figure (5) shows the output every 20 epochs, and the training stop when the Performance goal is met at epoch number 158. The procedure for backpropagation training is as follows, (for each input vector associate a target output vector):

```
while not STOP
  STOP=TRUE
  for each input vector
    perform a forward sweep to find the actual
    output
    obtain an error vector by comparing the
    actual and target output
    if the actual output is not within tolerance
    set STOP= FALSE
    perform a backward sweep of the error
    vector
    use the backward sweep to determine
    weight changes
    update weights
  end while
```

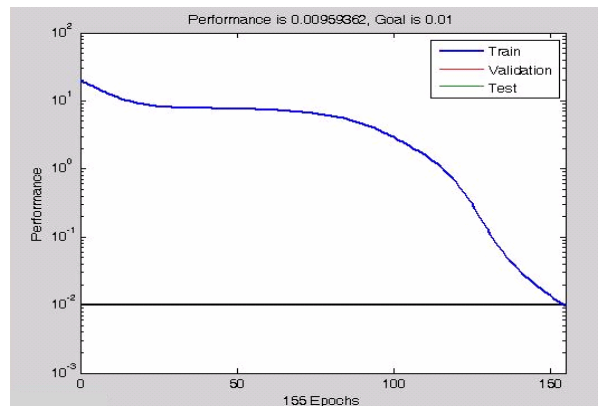


Figure (6): Performance vs. Number of Epoch

are larger than 0.9, and Figure (7-b) show a 9x9 matrix with diagonal values equal 1, which means that the outputs is equal the targets and the network is trained well.

0.9842	0.0139	0.0007	0.0096	0.0003	0.0083	0.0000	0.0086	0.0056
0.0095	0.9784	0.0048	0.0001	0.0004	0.0139	0.0022	0.0002	0.0133
0.0003	0.0072	0.9755	0.0018	0.0014	0.0004	0.0051	0.0100	0.0144
0.0180	0.0000	0.0005	0.9673	0.0087	0.0003	0.0062	0.0160	0.0083
0.0009	0.0016	0.0011	0.0005	0.9793	0.0204	0.0109	0.0006	0.0061
0.0033	0.0181	0.0005	0.0000	0.0098	0.9744	0.0002	0.0055	0.0001
0.0000	0.0002	0.0002	0.0004	0.0032	0.0001	0.9748	0.0162	0.0087
0.0120	0.0004	0.0122	0.0068	0.0009	0.0139	0.0191	0.9767	0.0001
0.0031	0.0057	0.0090	0.0173	0.0065	0.0000	0.0130	0.0000	0.9836

Figures (7-a)

1	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	1

Figures (7-b)

Figure (7): neural network output for Accidents Patterns Recognition

### 2.2.2 Training with Noise

To obtain a network not sensitive to noise, a new copy of the neural network was made and trains this network with two ideal copies and two noisy copies of the vectors of accidents. The target vectors consist also of four copies of the vectors in target. The noisy vectors have noise of mean 0.1 and 0.2 added to them. This forces the neuron to learn how to properly identify noisy accidents, while requiring that it can still respond well to ideal vectors.

$$P = [(P + \text{randn}(R, Q) * \text{noise percent } \%)]$$

To train with noise, the maximum number of epochs is reduced to 300 and the error goal is increased to 0.6, reflecting that higher error is

expected because more vectors (including some with noise), are being presented.

#### 2.3.2.1 Results of training with noise

An example of the ten passes, for training the network with noise shown in the following paragraphs. In pass2, as example, the goal is met after 5 epochs, where it means one of the stopping criteria is met. The stopping criterion here is the sum of squares errors (SSE).

##### Pass = 2

traingdx-calcgrad, Epoch 0/300, SSE  
0.67199/0.6, Gradient 1.35261/1e-006  
traingdx-calcgrad, Epoch 5/300, SSE  
0.588967/0.6, Gradient 1.10811/1e-006  
traingdx, Performance goal met, Figure (8).

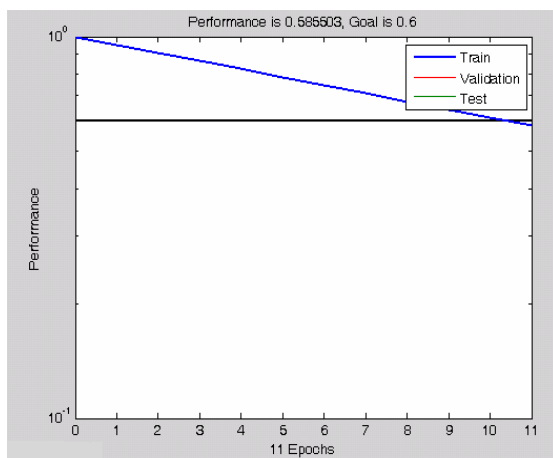


Figure (8): training with noise (Pass2)

##### Pass = 4

traingdx-calcgrad, Epoch 0/300, SSE  
0.998751/0.6, Gradient 2.18894/1e-006  
traingdx-calcgrad, Epoch 11/300, SSE  
0.585503/0.6, Gradient 1.29207/1e-006  
traingdx, Performance goal met, Figure (9).

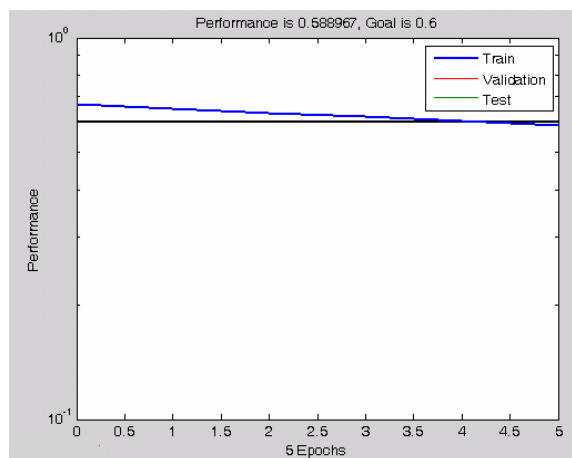


Figure (9): training with noise (Pass4)

##### Pass = 7

traingdx-calcgrad, Epoch 0/300, SSE  
1.22755/0.6, Gradient 1.04305/1e-006  
traingdx-calcgrad, Epoch 20/300, SSE  
0.912542/0.6, Gradient 1.58917/1e-006  
traingdx-calcgrad, Epoch 29/300, SSE  
0.592562/0.6, Gradient 1.11897/1e-006  
traingdx, Performance goal met, Figure (10).

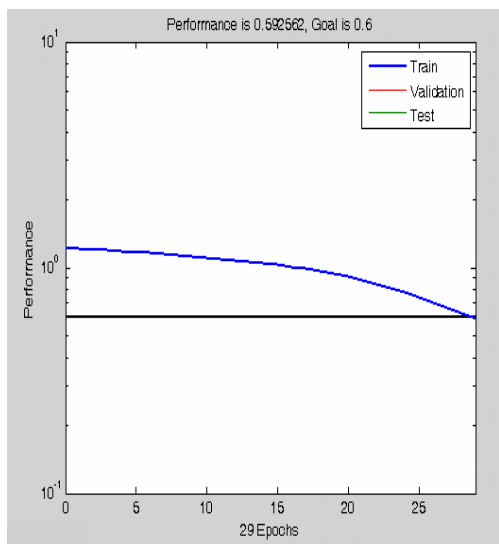


Figure (10): training with noise (Pass7)

**Pass = 9**

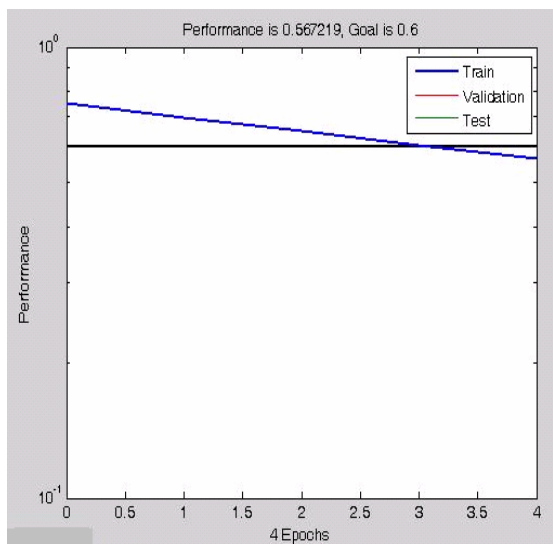
traingdx-calcgrad, Epoch 0/300, SSE  
0.752496/0.6, Gradient 2.33902/1e-006  
traingdx-calcgrad, Epoch 4/300, SSE  
0.567219/0.6, Gradient 1.64352/1e-006  
traingdx, Performance goal met, Figure (11).

**Pass = 10**

traingdx-calcgrad, Epoch 0/300, SSE  
0.523948/0.6, Gradient 2.13407/1e-006  
traingdx, Performance goal met.

**2.2.3 Training without Noise Again**

Once the network is trained with noise, it makes sense to train it without noise once more to ensure that ideal input vectors are always classified correctly. Therefore, the network is

Figure (11): training with noise (Pass9)  
again trained with code identical to the previous paragraph 2.3.1.**3.0 Results and Discussion**

The reliability of the neural network accidents recognition system is measured by testing the network with input vectors with varying quantities of noise. The script file *AccidentsRecogniton* tests the network at various noise levels, and then graphs the percentage of network errors versus noise. Noise with a mean of 0 and a standard deviation from 0 to 0.5 is added to input vectors. At each noise level, 100 presentations of different noisy versions of each accident are made and the network's output is calculated.

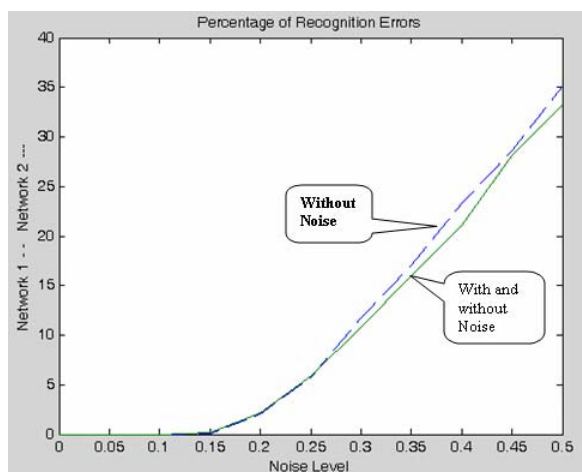


Figure (12): the reliability for the network trained with and without noise

In Figure (12), the *solid* line on the graph shows the reliability for the network trained with and without noise. The reliability of the same network when it was only trained without noise is shown with a *dashed* line. Thus, training the network on noisy input vectors greatly reduces its errors when it has to recognize noisy vectors and its output is approximately equal the training the same network without noisy input vector output.

The network did not make any errors for vectors with noise level of mean 0.00 or 0.14. When noise level of mean is larger than 0.15 was added to the vectors both networks began making errors.

If a higher accuracy is needed, the network can be trained for a longer time, or retrained with more neurons in its hidden layer. Also, the resolution of the input vectors can be increased to a 6-by-10 grid. Finally, the network could be trained on input vectors with greater amounts of

noise if greater reliability were needed for higher levels of noise.

To test the system, create an accident with noise and present it to the network. As example, when the accident TR2 (number 3), see figures (1), and add the noise using the "*randn()*" function to generate values from a normal distribution with mean 1 and standard deviation 2, then the output is passed through the competitive transfer function "*compet()*", that returns a matrix with a 1 in each column where the same column of the input has its maximum value, and 0 elsewhere. Figure (13-A) display the output of the noisy accident TR2, as the noise-free accident TR2 in figures (1), that means the network functioned correctly as expected. Also, when the same test carried out using accident TR4 and TR7, as examples, the same results were given; see figures (13-B), figures (13-C) and all other examples were tested.

```
accidents number= 5
Columns 1 through 13

    1    1    1    1    1    1    1    0    0    1    0    0

Columns 14 through 15

    1    1
```

Figures (13-A)

```
accidents number= 3
Columns 1 through 13

    1    1    0    1    1    0    0    1    1    1    1    1

Columns 14 through 15

    1    1
```

Figures (13-B)

```

accidents number= 8
Columns 1 through 13

    1    1    0    0    1    1    1    1    1    1    1    0

Columns 14 through 15

    0    0

```

Figures (13-C)

Figure (13): Sample Output of the system test when presenting sample of noisy input data to the neural network

The performance of a constructed network can be measured by investigating the network response in more detail, by performing a regression analysis between the network response and the corresponding targets. Where the entire data set are entered the network and a linear regression between the network outputs and the corresponding targets are performed. After the network output and the corresponding targets are passed to the Matlab's function 'postreg', it returns three parameters for the equation:

$$\text{Output} = m \text{ Target} + b$$

Figure (12) illustrates the graphical output provided by the function 'postreg'. The network outputs are plotted versus the targets as open circles. The best linear fit is indicated by a dashed line. The perfect fit (output equal to targets) is indicated by the solid line. In this figure, it is difficult to distinguish the best linear

fit line from the perfect fit line because the fit is so good.

$$\text{Output} = 0.97 \text{ Target} + 0.0073$$

From equation (2), the first parameter is the *slope*  $m=0.97$ , and the second one is the *y-intercept*  $b=0.0073$  of the best linear regression relating targets to network outputs. This output, you can see that the numbers are very close to the perfect fit (outputs exactly equal to targets), would be 1, and the y-intercept would be 0. The third parameter returned is the *correlation coefficient (R-value)* between the outputs and targets. The correlation coefficient (r) between two variables is a real number (r) which expresses the type and the degree of the relation between the two variables. It is a measure of how well the variation in the output is explained by the targets. If this number is equal to 1, then there is perfect correlation between targets and outputs. In the application, the number is very close to 1 (0.99953), which indicates a good fit.



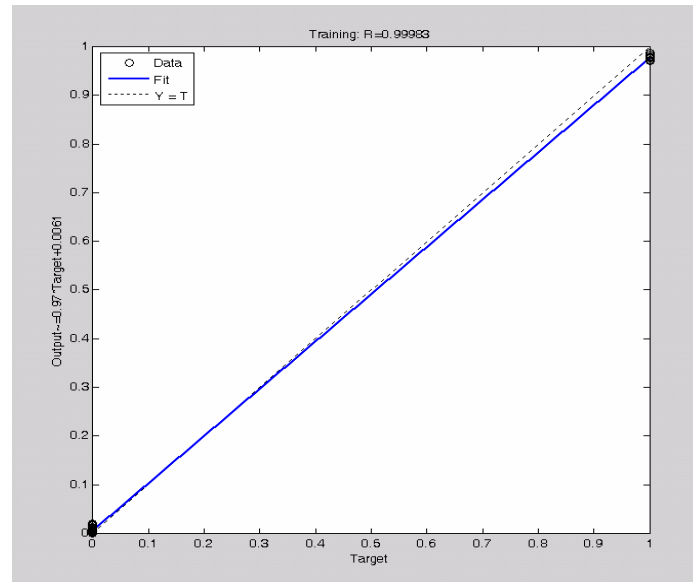


Figure (13): the reliability for the network trained with and without noise

#### 4.0 Conclusion

This paper proved the efficient use of an artificial neural network as a promising method for the nuclear reactor accidents patterns recognition. A two layers feedforward neural network with backpropagation training algorithm, which updates the network weights and biases in the direction of the negative of the gradient and trained with an adaptive learning rate combined with momentum training, Matlab's training function 'trngdx', is an efficient ANN to recognize the nuclear reactor accidents patterns.

By testing the network with input vectors with varying values of noise, the network did not make any errors for vectors with noise level of mean 0.00 to 0.14. When noise level of mean is larger than 0.15 was added to the vectors both networks began making errors, and the network still recognize the reactor accidents patterns.

The performance of the constructed network is investigated by performing a regression analysis between the network response and the corresponding targets. The results show the fit is very close to the perfect fit where it is difficult to distinguish the best linear fit line from the perfect fit line, where, the slope  $m=0.97$ , the y-intercept  $b=0.0073$ , and the correlation coefficient ( $R$ -value) between the outputs and targets is very close to 1 (0.99953), which indicates the fit is so good.

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**The Role of rural women empowerment in accelerating rural development**Azita Zamani<sup>1</sup> and Nahideh Erfanirad<sup>2</sup><sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran\*Corresponding author: [mehran11070@yahoo.com](mailto:mehran11070@yahoo.com)

**Abstract:** rural women take different responsibility and roles such as producers of crops , ranching and keeping poultry , children education , housekeeping , supervising family economy and managing it , collecting firewood , weaving carpet , so illiterate women who haven't possibility to utilize mass media properly too , wouldn't able to do their duties and roles and also wouldn't be effective to develop rural societies . So importance of education is very critical for rural women especially extensional educations. Approximately in most UN reports, women has been considered as greatest deprived group at human societies, while at global level, about two third of all affairs is done by women. But only one third of all recorded affairs relates to women. And also just 1% of proceeds of estates and assets of world belong to women and two third of illiterates of world are women, however they form 50% of workforce at agriculture part and they produce half of foods at all over the world.

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<http://www.americanscience.org>.

**Keywords:** empowerment, rural women, rural development

**Introduction:**

In all communities, rural women are considered as an important factor in achieving rural development goals and in fact are half of the manpower needed for rural development. However, in the rural community of Iran, there are gaps between the ruling class (capital owners) and villagers, between literate and illiterate, and between men and women. Especially in villages women have fewer possibilities in terms of investment and less power and credit. Role of rural women, over of men, is more influenced with different economic, social, cultural and ecologic factors. Rural women are considered as a noticeable potential in the community either directly (crops production, livestock, handicrafts, cottage industries) or indirectly by helping the agricultural sector (as labor). About 5.6 million women are involved in agricultural production, and activities related to planting... harvesting, preparation of animal food, and taking care of livestock and poultry and some certain activities related to trading and marketing are all different fields of rural women's role and participation. Based on current statistics, women in rural area participate about 50% in conversion industries, 22% in producing crops and livestock, 75% in handicrafts and in areas related to planting...harvesting , respectively, 25, 24 and 4.26. And also in activities related to livestock, they handle 23% of livestock grazing, 42% of animal care and 100 percent of total poultry in the village. Therefore their role in achieving food security is undeniable. But, like

employment, domestic workers, family workers, or independent employers. The statistics often do not take into account seasonal, part-time, unpaid employment, and housekeeping activities. In economics and social sciences, those of women's activities that have emerged out of house and affected national economy, are the ones to be noticed. In most research and statistics men are known as the heads of household and they are also the owners of lands and fields. That only 1% of the rural lands are belonging to women does confirm such matter (Samadi Afshar, 2004).

Development is a multidimensional process and has various economic, social, political and cultural dimensions. Rural women's participation has not been active and effective; because this participation's most important aspect, namely economics, is for rural women. However the value of their work in agricultural products is rarely considered as income and they are not independent either (Amiri, 2000).

For an active participation of women in development, first we need to give a definition for their role in development and then barriers related to their role will be discussed. Although apparently there is no difference of gender in development programs but reality is that women are less considered in participatory programs and most of these plans are planned for men. Finally, planner's optimistic look toward women's participation will be greatly helpful improve rural family budget and will increase the difference between urban and rural families. If, by credit, loans and other financial facilities, rural families are able to build up their own business and make a living through the income and become financially self-reliance or independent, no doubt we will witness some social, economic and cultural changes in villages (Varzgar and Azizi, 2001).

most developing countries, this crucial role in society and in process of rural development, is not obvious. In Iranian rural community, about 80% of women work, but they are mostly considered as housewives, unpaid

**Rural women's participation:**

Women, being half the population, play an effective role in the economic welfare of family and society. In Iran's economy, women are one of productive factors, but, so far, researchers and writers have ignored the issue of women's participation in economic activities. While in present situation considering the role of women's participation seems to be obligatory (Balali, 2005).

Participation in its broader sense means to motivate people and thus increase the sensitivity to understand and become responsive of development programs and it also carries the concept of local initiatives.

In fact, participation is to guide people caught by disability, to help them realize their potentials and to empower them to make the best use of life.

According to preceding definition of participation, and the ability of participation to turn potential into imminence power, women should participate more actively in economic affairs. Statistics regarding women and girls' activities, especially in rural areas, are always presented much lower than the real numbers (Ghaffari, 2000).

Village with the word "woman" removed will lose its literally in production and economic activities, their everyday activities in different fields all are evidence of woman being required in rural production. Rural girls and women are responsible for a variety of roles and duties including wife, mother, producing crops, livestock and agricultural activities, making and marketing handicrafts which are common in each area, and food preparation.

Daily activities of girls and women in different fields all are evidence of woman being required in rural production sector. Women are the major potential for developing the rural economy which leads to further growth of rural production. Increasing awareness towards the role of this class in production and towards necessity of their broader participation in economical and social development, have forced the countries to consider and support their activities while making new rural, Local and national policies (Rahmani Andalibi, 2001).

Being aware of women and girls' important role in rural activities, many countries have established institutes and organizations to advance women's progress. These organizations try to remove legal barriers that prevent women to participate in development activities as much as men. And finally improve their social, political and economic status in society. With continues evaluation and analysis of current development plans, we can provide especial conditions to ease women's access to production recourses and social services, and considering women's social situation in every society, we can provide the opportunity for them to increase

their participation, share income like men, and take part in decision-making (FAO, 1998 ).

If rural women could provide a job for them by getting credits, loan and other financial convenience, through their income they can get self-reliance or financial independency and we will see social, cultural & economic change in village. The question here is that if these changes have positive or negative aspects in the village? It's natural that every change in social phenomenon has both positive and negative aspect, but which is Important here is that which aspect is more than the other and it depends to different condition in various societies. In our rural society there is an especial social & cultural kind that it's outcome maybe different and in some case inconsistent. With these actions rural women could be in idealistic economic condition and they could live with out dependency to their husband's income. In most of the villages in Iran there is patriarchy in the families which is not acceptable for the most of the rural people and groups. When rural women became financially independent, it's acceptable to see its cultural & social outcomes.

Giving the right that women make decision, independency to their family, increasing the cultural knowledge among them& making relation with new institutions, having independency in making decision about marriage, occupation, migration & something like this are the right that women have got it.

Women by getting these rights can make change in the rural cultural & social issues which make disfunction & crudity in their family's relation. However, rural women's self-reliance has caused improvement in the economic, social & cultural issues. For solving women's self-reliance problems we can do these activities:

- Giving promotional services for increasing rural women's skills in various fields.
- Giving promotional instructions to men for believing their women's economic role & their women opportunity to participate in all economic, authority & ... aspects.
- Increasing rural women's knowledge in all social, political, cultural & economic fields.
- Making use of micro-credits programs to motivate & support women for doing economic affairs better & finally to make women self-reliance.

**Criteria of empowering women:**

Enabling as a theory of policy making for women, in it present five criteria:

Welfare, access, Concientisation, participation and control.

#### **1- welfare criteria :**

In this criteria, men and women as human resources of development should enjoy of desirable welfare conditions and equality (Paknazar, 2000).

Most of timing developmental programs, have worked on base of women's welfare. They have considered and provided some services for women who were passive recipient of these services. But these services were limited to physical needs and mostly were considered to revive their role of productivity, again. sometimes , it has been said that this approach has begun at colonial era and has considered women from poor country and intended services for them that dose not exceed from that poverty level . Agricultural and industrial projects were designed for men and social programs for women and children. Most of welfare programs were inadequate or its success was limited. Considerable point in this criteria is that men and women as human resources of development should enjoy equality and desirable welfare conditions. At this stage, women's material welfare and their enjoyment of welfare programs, compared to men (nutrition, death rate and ...) were considered. And women's role as producer to supply their own needs isn't very important.

#### **2- access criteria :**

Lack of access or limited access for women to sources including (fields, job, capital and training) cause that their functions at production is less than men (Paknazar 2000). Access to facilities, sources, designed program and projects for women and access to schools and ... are in this part. Just whenever most of other legal, cultural and social issues being solved, men and women would equally access to sources and facilities. Concept of enabling at this stage is that women have equal right to access to sources at family and greater society.

#### **3- Concientisation criteria**

Women should know that their problems aren't due to their individual inefficiency and shortage but it has emerged by social system in which discriminations has become formal and acceptable issue. (Araghzadeh, 2002). This stage is more critical and important than other stages. Because women can participate at development activities not just be passive users. Women have real equality at development, just when be aware. Concientisation will help to increase women's ability to equality at participation at society. At this stage, women face with critical analysis with society and will find that what has been considered natural and unchangeable reality, is changeable. (Bakhshodeh, 2005).

#### **4- Participation criteria**

One the most important items that this criteria has considered , is men and women's equal participation at decision making process of affairs of family at society (Paknazar 2000 ) . Men and women both should participate at process of assessment needs, designing, performing and evaluation of projects and development programs (UNICEF, 1998). In summary, this criterion means women's participation at all stages of surveying needs, detecting problems, planning, management, performing and valuation.

#### **5- Control criteria**

This criterion emphasize on this point that in addition to equal access of men and women to development sources , they must have adequate control on these sources that this issue is balance criterion , between men and women so that no one exceed other one (Paknazar 2000 ) . Women should have opportunities for decision making at workplace and home. If woman is producer, should be shared with part of her interest and wage. Women like men, should be able to choose her individual and social field and able to make decision and also development activities should be facilitator of these processes.

FAO (food and agricultural organization) addresses these three purposes as strategic goals while enabling women:

- 1- equality between men and women to access production sources
- 2- women's participation at policy and decision making
- 3- decreasing rural women's workload and increasing job opportunity and income for them (Paknazar 2000 )

within theoretical framework of enabling women , having control on sources is presented as highest stage at women's participation process on development , but existing data at most developing countries , indicates that not only rural women haven't any control on financial resources of family but even they were deprived to access to sources and credits , specially through formal credits system (Shaditalab, 2002 ) .

The question that arises here is that what relation is there between enabling women and micro-credits programs? Nowadays, micro-credits are considered as effective mechanism to eradicate poverty for women. Interests of micro-credits further increasing women's income, include:

- improving women's role in family
- Increasing women's confidence, not only through obtain financial success through business activity, but through increasing women's access to social services and communication with other women.
- Changing at social level (social class) at perspective of women's role.



**Discussion and results:**

In the new system of advanced agricultural economy, the value of women's work that previously was unpaid labor now must be paid in cash. Except for agriculture which is rural women's main work field they have rarely participated in tow other fields of economy. The most important issue of women's social and political participation is to take part in planning, decision making, implementation of decisions, and evaluation of results. Generally they have had a little share in such processes. Although in recent years rural women have participated more in villages' management, social and cultural organizations, and cooperative institutions' management; but having a lower level of literacy, education, income and social status than urban women they still have the smaller share of administrative and official jobs. Some barriers to women's participation which can be categorized in 3 groups of personal, familial, and social include: low literacy level, large volume of work both inside and outside of home for many reasons including seasonal migration of men and the great diversity of rural women's activities (nursing, housekeeping, agriculture, handicrafts, livestock,...), malnutrition, low health indicator, Patriarchal structure of society, father or husbands disagreement with a woman's participation in social and economic activities for various reasons like cultural reasons or unwilling to lose the labor force at home, negative attitudes towards women's abilities, gender discrimination, family's poverty, superstitious beliefs, misleading customs like fatalism, low access of women to credit and facilities, inaccessibility of extension services, men-orientated social activities and participation plans, deficiency of professionals needed to educate rural women, problems of access to health services and social facilities, low income of rural women compared with men, lack of non-governmental organizations dealing with rural women's problems, few women managers in rural area. (Rahimi, 2001)

Nowadays, micro-credit and micro-financing have changed people's lives; it has brought back life to poorest and richest communities of the world. So we can easily observe a great increase in people's access to general financial services. Facilitating the access of families to financial services, they begin to invest on educational expenses, healthcare, healthy nourishment, trading, and housing based on their priorities. Overall in many countries financial plans mostly focus on women. Women, provided with financial facilities, will receive a loan, guarantee to pay it back, keep their saving account and also they'll have insurance coverage. Micro-financial plans have an important message for families and communities. Many studies have proven that women's access to mentioned facilities may improve

their conditions in family and society; it also helps them feel more self-confident and makes them aware of their own abilities. Thus providing micro-credit services for the poor in society is a powerful tool to reduce poverty and so that they are able to create assets, earn more money and become less vulnerable against the economic pressure. Of about 1.3 billion poor in the world there are 900 million poor women, this obviously shows that poverty has a feminine face. According to UN's development fund, 10% of world's income and less than 10% of world's assets belongs to women. While a majority of them never possess the capital needed for their activities, women still play an important role in the economic development of country. Therefore women draw the micro-credit policy maker's attention more than others. Choosing women as the main target of micro-credit plans is an effective strategy to eradicate poverty; because their income will upgrade the family welfare; furthermore earning money improves their social status. In some countries this choice is influenced by society's attitude and culture (Araghzadeh, 2002).

For instance founder of Grumman Bank of Bangladesh, Mohammad Yunes, has stated that: "women have plans for themselves, their children, and their family life; they always have an overlook while men just look for fun" to explain why 94% of their clients are women.

Women's access to micro-credits have shown that their income benefit to improve their family and provide livelihood. In addition to all these another reason of women being the target of micro-credit plans is that women have higher loan recovery rates. Totally, expanding women's access to micro-credits may lead to many useful results which in economy is mentioned as "virtuous spiral"; because their access to micro-credits results in family welfare and in a broader point it'll improve community's welfare and shall be increased welfare this process is repeated.

In researches that conducted by Nanda (2004) became clear that women participation in credits programs had positive effects on their demand about health care. Fiona Steele and et al (2008) in researches that conducted as called "influences of credits programs on empowering women at Bangladesh", found that women who joined to credits programs, have participated in more educational programs and have married with more educated men and also they have saved more and they had more cash.

Shahnaj and Chaudhury (2009) in research as "credits and its role on empowering women" concluded that there is meaningful relation between attending in credits programs and empowering women, at economical dimensions.

Thus it is obvious that credits programs and its educational and empowering programs can be affective on social, humane and economic development or rural society, if it be associated with proper and gradual

practices and base on reciprocal communications principles and apply opinion of local society.

A study conducted by Chabokru et al (1384) shows the crucial importance of micro-credits for farmers who do not possess physical financial assets (land, building, livestock, well...) and work in agricultural sector because of environmental conditions (such as living in a village) or because it's their ancestral occupation.

So today, women's participation in sustainable economic, social, and cultural development in rural areas is not optional but an essential matter. Those communities that have not seriously considered the necessity of participation faced failures and delayed community's development, welfare and security process. In any community, village, or social group, broad participation of every women in decision-making and any other matter related to national or local development programs, is a key variable in social sciences and in the last few decades, it has interested many scholars of socio-economic and especially cultural issues, and is considered as one of the most fundamental democratic rights of women in a society. As we know in a popular participation, all people are given the opportunity to participate in planning and decision making for their society and for their own future. When in practice women feel that they can be involved in planning, policy making and deciding or solving problems in the society certainly they'll feel more solidarity and become more interested in social, economic, and cultural development programs.

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## Comparison between Hypertonic Saline and Isotonic Saline in Resuscitating Hypotensive Patients with Severe Traumatic Brain Injury; a Prospective Randomized Study

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**Abstract:** Introduction: The use of hypertonic saline in resuscitation of patients with traumatic brain injury (TBI) has been studied several times in the literatures. According to the knowledge of the authors, it was not compared to normal saline in resuscitation of such patient group in a head to head study. Hypothesis: To evaluate the efficacy of the use of a bolus 3% HTS against isotonic crystalloids in the resuscitation of hypotension associated with severe TBI. As regards early hemodynamic parameters, survival and neurological outcome after 3 months. Methods: 40 patients presented with hypotension (systolic blood pressure <100 mmHg) and severe TBI (GCS <9) were randomly classified into; GroupI: received 250 mL of 3% HTS as the primary resuscitation solution, GroupII (Control group): received 250 mL of normal saline. Then fluid resuscitation was continued as the condition of each patient dictates. Results: HTS group had statistically significant higher blood pressure (after one hour of resuscitation; p value = 0.003) than the control group though they received less amount of fluids (p value=0.0001). Regarding Glasgow outcome scale (GOS) at 3 months, there was a trend towards better outcome in the HTS group but that was not statistically significant. In the HTS group, the patients who survived were more, less patients with persistent vegetative state and more patients with good recovery or moderate disability than the control group. The mean of the GOS was higher in the HTS group but again with no statistically significant difference. In a subgroup analysis, HTS did not have any statistically significant difference on survival between the groups regarding the time interval between trauma and admission. Moreover, the use of HTS did not show statistically significant difference in the survival of patients having isolated head injury than those with associated injuries. Most importantly, there was no added beneficial effect on different degrees of severity of head trauma classified according to either GCS at admission or Marshall's classification of CT brain findings. Conclusions: HTS is effective in elevation of blood pressure in severe TBI patients while less fluid is required. Although not statistically significant, there was a trend towards improved outcome in severe TBI patients who received HTS.

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**Keywords:** Hypertonic Saline; Isotonic Saline; Resuscitating Hypotensive Patient; Traumatic Brain

### 1. Introduction:

Head trauma is injury to the scalp, skull or brain. This can range from a minor bump to the skull to a devastating brain injury. Head injury, which encounters the basis of some of the most frequent and serious neurogenic disorders, poses many problems to the practicing physician. Severe traumatic head injury (defined as the Glasgow Coma Scale of 3 to 8 and inability to follow commands) is the leading cause of morbidity and mortality in the age group between 10 and 45 years. (1-2)

There are two types of head injuries. Primary head injury that occurs at the time of the impact may involve neural or vascular elements of the brain. On the other hand, secondary brain injury (hours or days from the traumatic incident) is a major determinant of the patient's ultimate neurologic outcome. Goal of emergency and critical care management of patients

with severe traumatic brain injury is to enhance cerebral perfusion as well as to avoid therapy that may cause cerebral ischemia, thus avoiding secondary brain injury. Most common preventable causes of cerebral ischemia are hypotension, hypoxia and intracranial hypertension. (3)

Severe traumatic brain injury is usually a part of multiple traumas, in which hypotension (most commonly due to hypovolemia) is usually encountered. Rapid fluid resuscitation and restoration of the normal blood pressure is of crucial importance because hypotension has been associated with doubling of the mortality rate in severe traumatic brain injury. (3)

Crystalloids have been conventionally used in fluid resuscitation. These isotonic fluids diffuse freely from the intra vascular compartment to the interstitial compartment, and to some extent, to the

intracellular compartment causing tissue edema and impaired oxygen perfusion. Moreover, large quantities must be infused to adequately restore plasma volume. (4)

Hypertonic saline is any sodium chloride solution more concentrated than normal saline. Solutions of 3.0% to 7.5% are used. Hypertonic saline has received attention as a resuscitative fluid since the 1970s. (5-7) Its value in the resuscitation of burn victims is well documented. (8-9) It has been suggested that its use in brain edema and intracranial hypertension is comparable to Mannitol solution. (10) It also has some immunomodulating effects that may be helpful in the post resuscitative phase. (1) Research suggests that these fluids decrease the activation of neutrophils, (11) so they may offer an advantage in preventing multiple organ dysfunction syndrome. (12)

High concentrations of sodium chloride in the vascular system favor the flux of water from the interstitial space and from the cells to augment the blood volume. This results in a rapid restoration of intravascular volume. Once fluid is drawn into the vascular space, the sodium chloride is diluted, so it then equilibrates across the fluid spaces of the body. As this happens, the effect of the hypertonic saline is gradually lost. This occurs over a longer period of time than for standard crystalloid solutions, but it eventually occurs. Infusions of small amounts of these solutions lead to hemodynamic responses equivalent to much larger volumes of crystalloid solutions. This is advantageous due to the rapidity of the response. Although some rapid and transient hypernatremia seems to be tolerated, caution in administration and careful monitoring of sodium levels are important in the safe use of these solutions. (13-15)

### Hypothesis:

The aim of this work is to compare the use of hypertonic saline to normal saline in the early resuscitation of hypotension in severe traumatic brain injury patients, as regards neurological outcome and survival.

## 2. Patients and Methods:

### Patients

This study was carried out on 40 patients with severe traumatic brain injury and hypotension on admission to Alexandria Main University Hospital. The *inclusion criteria* included: Age group 15 -50 years or body weight >50 kg, history of blunt trauma to the head, systolic blood pressure <100 mmHg and a GCS < 9. The *exclusion criteria* included: Patients with previous history of any medical illnesses e.g.; hypertension, diabetes mellitus, cardiac, renal or

hepatic disease, history of neurological diseases or spinal cord injuries, known or suspected pregnancy, administration of >2 L of crystalloids, any colloids or blood products before admission, severe hypothermia (Temperature <28°C), drowning or asphyxia, burns of total body surface area (TBSA) > 20%, isolated penetrating injury to the head and time of the onset of trauma to study intervention >4 hours.

### METHODS:

The study is a prospective randomized double-blinded controlled pilot study. The study was conducted on forty patients admitted to the Alexandria Main University Hospital after approval of the ethical committee of the Faculty of Medicine, University of Alexandria. An informed consent was signed by a relative of patients participated in the study. All the patients were managed according to the following lines: *History included:* Biosocial data (name, age sex, occupation ...etc.), medical illnesses e.g. Hypertension, Diabetes mellitus, cardiac, renal or hepatic troubles, type, mechanism and time of the injury and interval of time between the onset of the trauma and the start of the management. *Clinical assessment:* Full physical examination included Vital signs (blood pressure, pulse, temperature and respiratory rate), admission Glasgow Coma Scale (GCS), and type of the injury (closed or penetrating) and assessment of associated injuries if present. *Radiological and Laboratory assessment:* Computed Tomography on the brain. Findings were classified according to Marshall classification(16) of CT brain in head injury (table 2 ), routine investigations e.g. random blood sugar (RBS), complete blood count (CBC), blood urea nitrogen (BUN) and serum creatinine (S Cr), arterial blood gases (ABG), serum electrolytes (Na and K). *Management:* Patient were managed according to their conditions: A. Primary management: Airway support, maintaining Oxygenation and Ventilation. B. *Circulatory support:* Patients were randomized into two groups of 20 patients each. The first group received 250 ml of 3% hypertonic saline (HTS) and the second control group received 250 ml normal saline (NS). After that, volume resuscitation was continued as required guided by blood pressure measurement. Double blinded randomization was ascertained. Forty bottles (20 bottles of 3% saline and 20 of normal saline) each of 250 ml were prepared. The labels of these were removed from the bottles and placed in sealed envelopes. Each envelope was assigned to a serial number referring to a correspondent patient. Accordingly, the treating physician did not know in advance the type of solution given for each patient. C. *Definitive management:* Either operative (according to the condition) or medical (e.g.



measures for brain edema and intra cranial hypertension) was accomplished as the condition of the patient dictates. *D. Follow up and Outcome:* Comparison between both groups as regards duration of use of vaso-active drugs if any, duration of intubation, duration of mechanical ventilation (17), duration of hospital stay, Glasgow outcome scale(18) and survival. *D. Statistic analysis:* Collected data and

statistical analysis was done using SPSS-14 (Statistical package for Social Sciences version 14).

### 3. Results:

Baseline characteristics are illustrated in table (1). It shows homogeneity of both groups without a significant difference between both groups regarding all variables on admission.

**Table (1): Baseline characteristics of the two study groups.**

	HTS Group (I) N=20	Control group (II) N=20	Significance (p value)
Age mean $\pm$ SD (Years)	28.60 $\pm$ 9.040	28.80 $\pm$ 13.18	0.956
Sex Males no. (%)	14(70.0%)	18(90.0%)	0.114
Females no. (%)	6 (30.0%)	2(10.0%)	
Mechanism of trauma no (%)			0.435
Road traffic accidents (RTA)	15 (75.0%)	15 (75.0%)	
Falling from a height (FFH)	2 (10.0%)	4 (20.0%)	
Blunt trauma	3 (15.0%)	1 (5.0%)	
Time interval between trauma and admission (minutes) (mean $\pm$ SD)	34.75 $\pm$ 22.564	51.25 $\pm$ 53.702	0.213
Blood Pressure on admission (mmHg)			0.894
Systolic BP (mean $\pm$ SD)	81.05 $\pm$ 11.002	80.56 $\pm$ 11.618	
Diastolic BP (mean $\pm$ SD)	51.58 $\pm$ 13.850	52.22 $\pm$ 10.603	
Mean BP (mean $\pm$ SD)	61.40 $\pm$ 11.932	61.67 $\pm$ 10.556	
Glasgow Coma Score			0.380
Total (mean $\pm$ SD)	5.15 $\pm$ 1.531	5.60 $\pm$ 1.667	
Motor (mean $\pm$ SD)	2.95 $\pm$ 1.276	3.35 $\pm$ 1.599	0.387
Heart Rate (mean $\pm$ SD)	114.35 $\pm$ 26.158	109.50 $\pm$ 21.758	0.528
Respiratory Rate (mean $\pm$ SD)	18.10 $\pm$ 5.360	17.95 $\pm$ 4.310	0.923
Temperature (mean $\pm$ SD)	36.475 $\pm$ 0.6172	36.300 $\pm$ 0.6366	0.383
Associated injuries no (%)			
Chest	4 20.0%	6 30.0%	0.465
Abdomen	4 20.0%	8 40.0%	0.168
Pelvis	4 20.0%	1 5.0%	0.151
Upper limbs	1 5.0%	5 25.0%	0.077
Lower limbs	4 20.0%	4 20.0%	1.000
Laboratory Investigations:			
Arterial Blood Gases (Mean $\pm$ SD)			
pH	7.322 $\pm$ 0.1039	7.313 $\pm$ 0.1323	0.812
PaO <sub>2</sub> (mmHg)	99.68 $\pm$ 60.853	69.40 $\pm$ 16.119	0.038
PaCO <sub>2</sub> (mmHg)	29.30 $\pm$ 10.770	29.35 $\pm$ 9.331	0.988
HCO <sub>3</sub> (mmHg)	17.05 $\pm$ 3.686	17.61 $\pm$ 4.751	0.682
SaO <sub>2</sub> (%)	93.30 $\pm$ 4.635	92.25 $\pm$ 3.754	0.436
Hemoglobin g/dL (mean $\pm$ SD)	9.02 $\pm$ 2.221	12.36 $\pm$ 14.983	0.343
White blood Count (x10 <sup>3</sup> /dL) (mean $\pm$ SD)	15.925 $\pm$ 5.035	15.930 $\pm$ 5.9793	0.998
Sodium (mean $\pm$ SD) mg/dL	141.10 $\pm$ 3.582	140.30 $\pm$ 3.785	0.497
Potassium (mean $\pm$ SD) mg/dL	4.020 $\pm$ 0.4708	3.900 $\pm$ 0.4690	0.424
Random Blood glucose level (mean $\pm$ SD) mg/dL	176.15 $\pm$ 35.74	191.6 $\pm$ 25.05	0.109

**CT brain Findings:**

CT brain findings (classified according to Marshall's classification) were compared between the two groups (after resuscitation and surgical intervention if any) and presented in table 2. In general, there was no statistically significant difference in CT brain findings in the two groups (p value 0.505). The most common CT finding among

the two groups was diffuse injury II (13 patients, 6 in group I and 7 in group II). Diffuse injury III and IV each was presented by 7 patients. The rate of operations for a mass lesion was slightly commoner in the HTS group (4 patients) than the control group (only 2 patients) and the number of patients with non evacuated mass lesion was evenly distributed (3 patients each).

**Table 2: CT brain findings in the study groups according to Marshall's classification.**

CT brain (Marshall's classification)	HTS Group N=20	Control group N=20	Significance (p value)
Diffuse injury I	0 0%	1 5.0%	0.505
Diffuse injury II	6 30.0%	7 35.0%	
Diffuse injury III (swelling)	5 25.0%	2 10.0%	
Diffuse injury IV (shift)	2 10.0%	5 25.0%	
Evacuated mass lesion	4 20.0%	2 10.0%	
Non evacuated mass lesion	3 15.0%	3 15.0%	

HTS= Hypertonic saline

**Follow up and outcome (table 3)**

There has been a highly significant difference (p value 0.0001) between the two groups regarding the Total Fluids used in the resuscitation of hypotension (at one hour) in the two groups. The mean of the fluids taken in group I was  $1225 \pm 72.9$ . This was much less than the fluids used in the control group with a mean  $\pm$ SD =  $2087.5 \pm 481.7$ .

Most importantly, Blood Pressure (systolic, diastolic and mean arterial blood pressure) measurement after one hour of resuscitation had increased in both groups. However, blood pressure measurements were significantly higher in the group of patients that received HTS as the initial resuscitation solution, the mean of the three parameters (systolic, mean and diastolic) calculated 111.25, 74.25 and 86.4 respectively while in group II the mean was calculated 98.42, 62.37 and 72.8 respectively. The p values calculated were (0.008, 0.003 and 0.003) respectively.

On the other hand, Serum Na measured after one hour was significantly higher in the HTS group compared to the control group (p value 0.0001). In the group of patients that received 3% hypertonic saline, the mean was 146.35 mg/dL (was 141.1 mg/dL at admission) while the mean in the control group was 141.84 mg/dL (was 140.3 mg/dL at

admission). However, it did not exceed the normal range (135 to 150 mg/dL).

Regarding survival of the patients in both groups for the first 24 hours, only 3 patients in each group could not survive the 1<sup>st</sup> 24 hrs.

The durations of intubation, mechanical ventilation, use of vasoactive drugs and hospital stay were compared in the two groups. Although they were more in the control group, this was not statistically significant. Though not statistically significant (p value = 0.19), patients who survived (assessed at 3 months) were higher in the group of patients who received HTS (11 out of 20) than in the control group (8 out of 20).

The GOS assessed at 3 months was compared between the two groups; the mean was higher in group I (2.5) than the control group II (1.8). However, this was statistically insignificant (p=0.121). The five components of GOS (Death, Vegetative state, Severe disability, Moderate disability and Good recovery) were compared between the two groups and the number of the non survivors was higher in the control group I (12 vs. 9) as well as the number of persistent vegetative state (3 vs. 1). Furthermore, those who had good recovery and moderate disability were higher in the HTS group (both 3 vs. 1). However, all these results were statistically insignificant.

**Table 3: Follow up and outcome**

	HTS group N=20	Control group N=20	Significance (p value)
Total fluids at 1 hr. (mean $\pm$ SD)	1225.0 $\pm$ 572.9	2087.5 $\pm$ 481.7	0.0001*
Blood Pressure (BP) after 1 hour			
Systolic BP mmHg (mean $\pm$ SD)	111.25 $\pm$ 10.745	98.42 $\pm$ 17.083	0.008
Diastolic BP mmHg (mean $\pm$ SD)	74.25 $\pm$ 8.156	62.37 $\pm$ 14.754	0.003
Mean BP mmHg (mean $\pm$ SD)	86.4 $\pm$ 8.2	72.8 $\pm$ 15.9	0.002*
Sodium after 1 hour (mean $\pm$ SD) mEq/L	146.35 $\pm$ 2.390	141.84 $\pm$ 3.253	0.0001*
First 24 hours survival (patients no. and %)	17(85%)	17(85%)	0.99
Intubation duration (days) mean $\pm$ SD (including Tracheostomy days)	24.05 $\pm$ 31.842	27.30 $\pm$ 34.556	0.759
Mechanical ventilation duration (days) mean $\pm$ SD	3.4 $\pm$ 2.761	5.25 $\pm$ 3.354	0.07
Vasoactive drugs (days used) mean $\pm$ SD	0.70 $\pm$ 0.923	1.10 $\pm$ 1.373	0.286
Hospital stay (days) mean $\pm$ SD	28.63 $\pm$ 32.803	31.05 $\pm$ 35.214	0.826
Patients survived (no.)	11 (55%)	8 (40%)	0.19
GOS mean $\pm$ SD	2.5 $\pm$ 1.57	1.8 $\pm$ 1.1	0.121

GOS= Glasgow Outcome Scale

**Subgroups analysis (table 4)**

Patients were divided into different subgroups according to biosocial data, clinical findings and investigations to compare outcome between the two groups and to test if the use of HTS as the initial resuscitation solution in hypotensive patients with severe traumatic brain injury could benefit any of these subgroups.

Patients were classified into different age groups (15 to 30 years, 30 to 40 years and 40 to 50 years). There was no statistically significant difference regarding survival in different age groups. The worst outcome was among the older age group where 6 out of 7 patients (in both groups) did not survive. A relatively better outcome was observed among the younger age group where eight out of 11 could survive in the HTS group versus seven out of 12 in the control group. All the three patients in the control that were between 30 and 40 years old could not survive while three out of seven patients survived in the HTS group in the corresponding age group.

Regarding the sex, there was no significant effect by the use of HTS as regards survival at 3 months in the different genders. However, HTS had a relatively better effect on males as 10 survived out of 18 male patients while 5 only out of 14 male patients could survive in the control group (p=0.62). On the other hand, 50% of females survived in both groups.

The interval of time between trauma and admission did not have impact on survival in both groups. However a relatively insignificant better outcome was obtained by the use of HTS in the longer time interval where three among five patients

survived while all the five patients who arrived late in the control group did not survive (p=0.46).

The mechanism of trauma did not have effect on survivors in both groups. Moreover, the use of HTS did not have effect on survival of patients having associated injuries other than head injury (p=.11).

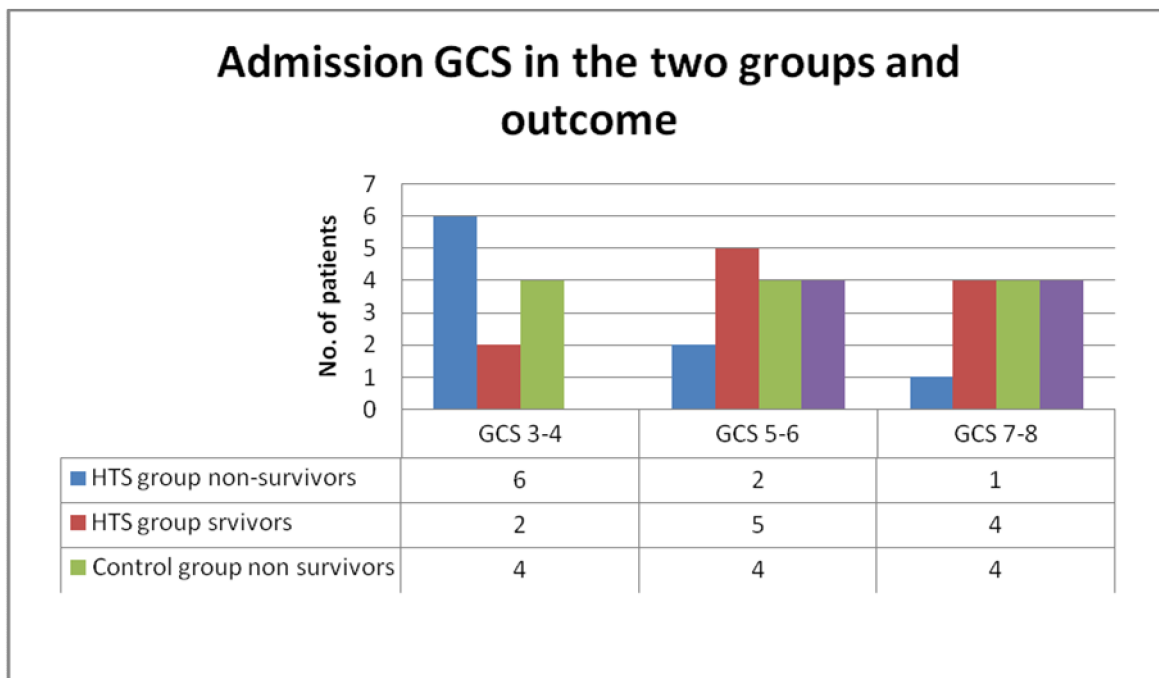
GCS was categorized into 3 groups milder (7 or 8), moderate (5 or 6) and more severe (3 or 4). HTS couldn't prove any benefit of use in the three categories. However, the p value (0.088) is approaching significance in those who had better score with GCS assessed at admission either 7 or 8 indicating that HTS could have a fairly better outcome on the patients that had higher GCS (7 or 8) on admission. Similarly, all patients with worse GCS (3 or 4) that didn't receive HTS died, While two out of eight patients survived among those who received HTS (p value 0.09).

CT brain findings (according to Marshall's classification; (Table 5) were compared against outcome in the two groups and there was no statistically significant difference in any of the 6 categories indicating that HTS had no added benefit on different degrees of intracranial pathology in the present study.

Similar outcome was noticed in different categories of CT brain findings in the two groups. All the patients that had diffuse injury IV (5 in the control group and 2 in the HTS group) or non evacuated mass lesion (3 in both groups) could not survive. All the patients that had undergone surgical evacuation for a mass lesion had survived.

**Table 4: Subgroups analysis**

	HTS Group N=20		Control Group N=20		p
	Non survivors N=9	Survivors N=11	Non survivors N=12	Survivors N=8	
Age (Years) n (%)					
15-30 years	3 (33.3%)	8 (72.7%)	5 (41.7%)	7 (87.5%)	0.16
30-40 years	4 (44.4%)	3 (27.3%)	3 (25.0%)	0 (0.0%)	0.12
40-50 years	2 (22.2%)	0 (0.0%)	4 (33.3%)	1 (12.5%)	0.42
Sex n (%)					
Males	8 (88.9%)	10 (90.9%)	9 (75.0%)	5 (62.5%)	0.62
Females	1 (11.1%)	1 (9.1%)	3 (25.0%)	3 (37.5%)	0.11
Time interval between trauma and admission:					
< 30 min.	3 (33.3%)	6 (54.5%)	2 (16.7%)	4 (50.0%)	0.42
30 - 60 min.	4 (44.4%)	2 (18.2%)	5 (41.7%)	4 (50.0%)	0.39
> 60 min.	2 (22.2%)	3 (27.3%)	5 (41.7%)	0 (0.0%)	0.46
Mechanism of trauma					
Road Traffic Accident no. (%)	6 (66.7%)	9 (81.8%)	8 (66.7%)	7 (87.5%)	0.68
Fall From a Height no. (%)	2 (22.2%)	0 (0.0%)	3 (25.0%)	1 (12.5%)	0.22
Blunt trauma no. (%)	1 (11.1%)	2 (18.2%)	1 (8.3%)	0 (0.0%)	0.82
Associated injuries no.	9	4	7	3	0.42
Chest no. (%)	2 (22.2%)	2 (18.2%)	4 (33.3%)	2 (25.0%)	0.36
Abdomen no. (%)	3 (33.3%)	1 (9.1%)	6 (50.0%)	2 (25.0%)	0.25
Pelvis no. (%)	4 (44.4%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	0.041*
Upper Limbs no. (%)	0 (0.0%)	1 (9.1%)	2 (16.7%)	3 (37.5%)	0.21
Lower Limbs no. (%)	3 (33.3%)	1 (9.1%)	2 (16.7%)	2 (25.0%)	0.13



**Figure 1: Admission GCS grouped into milder (GCS 7, 8), moderate (GCS 5, 6) and more severe (GCS 3, 4) and compared to outcome in the HTS and the control groups.**

**Table 5: CT brain Marshall's score versus outcome in each group**

CT brain		HTS group		Control group		p value
		Died	Survived	Died	Survived	
1 Diffuse Injury I	No.	0	0	0	1	-
	%	0.0	0.0	.0%	12.5%	
2 Diffuse Injury II	No.	1	5	2	5	0.61
	%	11.1%	45.5%	16.7%	62.5%	
3 Diffuse Injury III	No.	3	2	2	0	0.11
	%	33.3%	18.2%	16.7%	.0%	
4 Diffuse Injury IV	No.	2	0	5	0	0.09
	%	22.2%	.0%	41.7%	.0%	
5 Evacuated Mass Lesion	No.	0	4	0	2	0.19
	%	.0%	36.4%	.0%	25.0%	
6 Non evacuated mass lesion	No.	3	0	3	0	0.99
	%	33.3%	.0%	25.0%	.0%	
Total	No.	9	11	12	8	0.13
	%	100.0%	100.0%	100.0%	100.0%	

#### 4. Discussion:

HTS has been suggested for use in severe TBI since 1919. (19) However, few patients have been studied using a prospective, randomized, control study design. Complicating the interpretation of these findings is a variation in protocols regarding HTS concentration and administration when used in patients who have experienced TBI. In the present study, the baseline characteristics of the two groups were similar without a significant difference between both groups. In the present study, the patients who received HTS had significantly higher blood pressure (after one hour of resuscitation) than the control group although they received much less amount of fluids during the same period. The serum Na assessed after resuscitation was significantly higher but it did not exceed the normal range. First 24 hours survival was identical (85%) between the two groups. Although not statistically significant, the number of patients who survived (after 3 months) was higher as well as the number of persistent vegetative state was less. Furthermore, those who had good recovery and moderate disability were higher in the HTS group. However, the mean of the GOS (assessed at 3 months) was compared between the two groups and there was no statistically significant difference.

In a subgroup analysis, patients were divided into different subgroups according to biosocial data, clinical findings and investigations to compare outcome between the two groups in order to test if the use of HTS as the initial resuscitation solution in

hypotensive patients with severe traumatic brain injury could affect survival after 3 months in any of these subgroups. In the present study, there was no significant difference regarding the use of HTS in different age groups as well as in different sexes. Twenty Four hours survival was the same in the two groups. HTS did not have any statistically significant effect on survival between the shorter, intermediate or longer interval of time between trauma and admission. Moreover, the use of HTS did not differ in the survival of patients having isolated head injury or those who have associated injuries other than head injury. Most importantly, there was no added beneficial effect on different degrees of severity of head trauma classified according to either GCS at admission or Marshall's classification of CT brain findings.

Many animal studies tested the use of hypertonic saline vs. isotonic fluids to control hemorrhagic shock and the largest series of experiments used various animal models of TBI with hemorrhage to examine the effects of HTS on intracranial pressure (ICP). For example, Gunnar et al. (20) used a dog model of epidural balloon inflation and hemorrhagic shock and observed a decrease in ICP and cerebral water content and a decline in the incidence of herniation with HTS versus normal saline (NS) or dextran which showed increase in the ICP and less mean arterial pressure (MAP) and cerebral perfusion pressure (CPP). Interestingly, they used Evans blue solution to



evaluate blood-brain barrier integrity and found an increase in staining with HTS, which they speculated was a result of enhanced perfusion to injured areas. Two studies evaluated the efficacy of HTS as both a resuscitation fluid and a maintenance fluid. Walsh et al. (21) used a swine model of cryogenic injury and hemorrhage to examine the efficacy of HTS versus LR. Animals were randomized to receive an initial bolus of LR versus 7.5% HTS and were again randomized to undergo continuous infusion with either fluid, making this one of the first studies to use HTS as both a resuscitation fluid and a maintenance fluid. They found that an initial HTS bolus prevented the ICP increase observed with isotonic fluid resuscitation. An increase in cerebral blood flow (CBF) and a lower cortical water content was observed in animals receiving HTS as both bolus and maintenance therapy. In addition, a continuous infusion of HTS was able to maintain ICP near normal, whereas animals receiving Lactated Ringer's (LR) maintenance experienced a slow rise in ICP. Shackford et al. (22) also used a swine model of cryogenic injury and hemorrhage to compare LR and HTS for both resuscitation and maintenance. Animals resuscitated with HTS had improved MAP, higher CBF, and lower ICP values; the effect on ICP lasted up to 6 hours, even when LR was used for maintenance. Only those animals given HTS both as initial bolus and as maintenance had ICP measurements below 20 mm Hg at 24 hours; this same group also had the highest CPP. There were no significant differences between groups with regard to cerebral water content.

Vassar et al. (23) were among the first investigators (as a clinical trial) to evaluate HTS as a prehospital resuscitation fluid. Dextran was added to HTS on the basis of its potential to augment the favorable hemodynamic effects of HTS. They reported 20 trauma patients transported by helicopter who were randomized to receive either 7.5% HTS/4.2% dextran (250 mL) or Lactated Ringer's (LR) 250 mL followed by supplemental LR as needed to maintain systolic blood pressure (SBP) of 100 mm Hg or greater. They observed a statistically significant increase in SBP and overall survival in patients receiving HTS. The study was significantly limited by its small sample size; furthermore, the LR group had higher incidence of severe TBI as defined by lower GCS scores, making the improved survival observed in the HTS group difficult to interpret. Nevertheless, this was one of the first studies that demonstrated the efficacy of HTS to increase SBP in the clinical setting.

The same group then prospectively studied 166 trauma patients during their transport by helicopter using the same protocol. The HTS group

had smaller fluid requirements for hemodynamic stabilization and a higher SBP. (24) The improvement in survival to discharge with HTS did not reach statistical significance for the entire population but was statistically significant for the subgroup of patients with severe traumatic brain injury. There were no significant differences between groups regard to the injury severity as reflected by GCS score, Injury Severity Score, or Revised Trauma Score.

The same group (25) then performed a multicenter trial to compare 7.5% HTS, 7.5% HTS/6% dextran, 7.5% HTS/12% dextran, and LR (250mL of each in hypotensive trauma patients, and again observed improvements in SBP with HTS. No differences in overall survival were observed; however, survival was significantly higher than predicted in patients receiving HTS but not LR. In addition, subgroup analysis of patients with an initial GCS score of 8 or less revealed significant improvements in survival to hospital discharge with use of HTS. Again, dextran appeared to confer no additional benefit over HTS alone.

Wade et al. (13) performed a meta-analysis using these studies to evaluate the effect of HTS/dextran on patients with TBI and SBP of 90 mm Hg or less. Primary outcome measures included 24-hour survival and survival to hospital discharge, both of which were higher in patients receiving HTS/dextran (38 vs 27%, odds ratio 2:1,  $p=0.048$ ). After adjusting for confounding variables (e.g. Severity of head trauma and presence of associated injuries) the survival benefit with HTS/dextran reached statistical significance.

Shackford et al. (26) enrolled 34 patients with severe head injury and used ICP monitoring in a prospective randomized controlled trial. They used 1.6% HTS vs. Ringer's lactate to treat episodes of hemodynamic stability during initial resuscitation. The study showed no significant difference regarding the ICP measured between the two groups and there was no significant differences regarding Glasgow outcome score at discharge. However, limitations of this study include the use of low concentration of HTS; the HTS group had more severe injuries and the few number of patients.

Simma et al. (15) enrolled 32 children with severe head injury and also used ICP monitoring. 1.6% HTS was compared to Ringer's lactate as the only IV fluid for 3 days following injury. They found no significant difference as regard survival though hospital and ICU stay were significantly less. However, study limitations include small number of sample, the use of the same low concentration of HTS.

In a large double blind, prospective randomized controlled study, Cooper et al. <sup>(27)</sup> enrolled 229 patients who had severe head injury (GCS<9) and were hypotensive (BP <100mmHg) between the years 1998 and 2002 in Melbourne, Australia. Patients were randomly assigned to receive a rapid intravenous infusion of either 250 mL of 7.5% saline (n=114) or 250 mL of LR solution (n=115; controls) in addition to conventional intravenous fluid and resuscitation protocols administered by paramedics during the pre-hospital period. Significantly, there was no difference in total resuscitation IV fluids (1,250 ml) and SBP on arrival unlike other studies. A higher serum Na and Chloride (26) were noted with HTS on admission, which lasted approximately for 12 hours. No difference was seen in ICP, cerebral perfusion pressure (CPP), duration of CPP <70, gas exchange, duration of mechanical ventilation or duration of inotropic support between the groups. Although the number of patients who survived was more in the HTS group, this did not reach statistical significance. Furthermore, there was no statistically significant difference as regards extended Glasgow outcome score assessed at 3 and 6 months period. However, the survival was better in both groups than predicted by trauma and injury severity score (TRISS), and the LR group may have benefited from an excellent prehospital resuscitation protocol to maintain an adequate CPP that obviates the need for HTS. Also, this was a limited trial, which did not address HTS only or HTS/dextran resuscitation, and did not use HTS during the hospitalization, which may also affect outcomes.

Therefore, it may be that adequate volume and hemodynamic resuscitation is in fact the critical factor in improving neurological outcome. Additionally, the beneficial effects of HTS resuscitation improving cardiovascular parameters while still limiting the amount of fluid may have been obviated in this study. Also, there may be a need to have a sustained hyperosmolar state. Thus, the initial HTS resuscitation may not have prevented the usual cascade of cerebral edema, increased ICP and secondary brain injury. This can be evaluated by using a protocol that titrates resuscitation fluid administration tightly to cardiovascular parameters, although this may be difficult in the prehospital setting.

## 5. Conclusion:

HTS is effective in elevation of blood pressure in severe TBI patients while less fluid is required. Although not statistically significant, there was a trend towards improved outcome in severe TBI patients that received HTS.

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## Prediction of the Outcome of Patients with Acute Hydrocarbons Poisoning using Poison Severity Scoring System; A Prospective Study

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**Abstract:** PURPOSE: Accidental hydrocarbons ingestion remains a serious contributor to childhood poisoning in low socioeconomic groups, with a high incidence of morbidity and occasional mortality. Hydrocarbon toxicities affect mainly the respiratory system and pulmonary pathology is the most serious complication. Although most children survive without complications or sequelae, some progress rapidly to respiratory failure and death. In this study, we aimed to investigate whether it was possible to predict outcome in hydrocarbons poisoning using a scoring system based on simple clinical parameters recorded solely on admission. METHODS: 100 patients with acute hydrocarbon toxicity consequently admitted to the Poisoning center will be subjected to full history taking, complete physical examination. Plain chest x-ray, ECG, ABG and routine blood investigations (CBC, Na, K, serum and Creatinine, AST and ALT) were done on admission. All patients were graded according to the Poison Severity Score (PSS) to either: None (0), Minor (1), Moderate (2), Severe (3) or Fatal (4). Their initial grading was correlated with their outcomes: Need for Intensive Care Unit admission, mechanical ventilation (MV) and the length of ICU and hospital stay as well as hospital mortality. RESULTS: 100% of the patients with grade (None=0) recovered completely and none was admitted to the ICU with a mean hospital stay of  $1 \pm 0.0$  day. 100% of the patients with grade (Minor=1) recovered completely and none was admitted to the ICU with a mean hospital stay of  $1.26 \pm 0.44$  days. 100% of the patients with grade 2 (Moderate) recovered completely. All of them were admitted to the ICU, 64.3% of them needed invasive mechanical ventilation and 35.7% did not. The mean hospital stay was  $3.50 \pm 0.65$  days and the mean ICU stay was  $2.50 \pm 0.65$  days. 25% of the patients with grade 3 (Severe) recovered completely and 75% died (hospital mortality). All of them were admitted to the ICU and needed invasive mechanical ventilation. Their mean hospital stay was  $5.25 \pm 2.99$  days and the mean ICU stay was  $5 \pm 2.58$  days. CONCLUSIONS: According to this study, the PSS could be a useful tool to predict outcome in patients admitted with hydrocarbon toxicity as the different grades of the PSS system had significant correlation with patients' outcome. Patients presenting with hydrocarbons with a PSS of  $\geq 2$  could be directly admitted to the ICU for possible need of MV because of associated unfavorable outcome.

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**Keywords:** Patients; Acute Hydrocarbons; Poison; Scoring System; Prospective Study

### 1. Introduction:

Hydrocarbons are organic substances that contain carbon and hydrogen; they are liquid at room temperature. All petroleum distillates (e.g., kerosene, gasoline, mineral seal oils, and naphtha) are hydrocarbons; however, not all hydrocarbons are petroleum distillates. Turpentine, for example, is a hydrocarbon made from pine oil. Hydrocarbons also often are mixed with agents that have systemic toxicity such as camphor, aniline dyes, heavy metals, and pesticides.<sup>1</sup>

Hydrocarbon ingestion accounts for two to three percent of non-pharmaceutical exposures in children younger than six years of age reported to US poison control centers.<sup>2</sup> In developing countries, studies suggest poisonings represent up to 2% of all

pediatric hospital admissions and that kerosene aspiration may represent half of all poison admissions in the group less than five years of age. Admissions for hydrocarbon exposure were also longer than those for other poisonings.<sup>3</sup> Young children are at greatest risk of paraffin poisoning. Because paraffin has the consistency and appearance of water and in some places is stored in reused beverage containers without child-resistant caps, unsupervised children are at high risk of consuming it. Toxicity in adolescents often arises from inhalant abuse of hydrocarbons.<sup>4-5</sup>

Organ systems that can be affected by hydrocarbons include the pulmonary, neurologic, cardiac, gastrointestinal, hepatic, renal, dermatologic, and hematologic systems. The pulmonary system is the most commonly involved system.<sup>6</sup>

Pulmonary manifestations result from any degree of hydrocarbon aspiration, although their onset may be delayed for 12 to 24 hours. Immediate signs of aspiration include coughing, choking, gagging, and vomiting. Respiratory examination findings vary with the degree of pulmonary injury. Physical findings may include tachypnea, dyspnea, cyanosis, diminished resonance on percussion, suppressed or tubular breath sounds, and crackles. The radiographic findings of hydrocarbon aspiration often occur before the development of physical findings. They may be seen within 20 minutes or as late as 24 hours after aspiration.<sup>7-9</sup>

Cardiac arrhythmia also may occur after inhalation. Solvent hydrocarbons can sensitize the myocardium to catecholamines, leading to fatal arrhythmia ("sudden sniffing death").<sup>10</sup> Ingestion of aliphatic hydrocarbons causes direct local irritation to the pharynx, esophagus, stomach, and small intestine, with edema and mucosal ulceration. Oro-gastric and intestinal irritation may be associated with nausea and hematemesis.<sup>11</sup> Hydrocarbon ingestion or inhalation may have direct CNS effects, including somnolence, headache, ataxia, dizziness, blurred vision, weakness, fatigue, lethargy, stupor, seizures, and coma. In addition, hypoxia caused by hydrocarbon aspiration may cause secondary CNS depression, including drowsiness, tremors, or convulsions.<sup>10</sup> Leukocytosis occurs early in the clinical course of hydrocarbon aspiration unrelated to pneumonitis and may last as long as one week. Hemolysis, hemoglobinuria, and consumptive coagulopathy also may occur with significant ingestion.<sup>12</sup>

In this study, the aim was to investigate whether it was possible to predict inpatient mortality in hydrocarbons poisoning using a scoring system based on simple clinical parameters and simple laboratory investigations recorded solely on admission.

Scoring systems have been used in clinical toxicology for many years. A standardized scheme for grading the severity of poisoning allows qualitative evaluation of the morbidity caused by poisoning, better identification of real risks, and comparability of data.<sup>13</sup>

Working from a simple grading proposed by the European Association of Poisons Centers and Clinical Toxicologists, a Poisoning Severity Score has been developed jointly with the International Programme on Chemical Safety and the European Commission. The Poisoning Severity Score has been elaborated, tested, and gradually revised during a project running 1991-1994. The Poisoning Severity Score grades severity as none (0), minor (1), moderate (2), severe (3), and fatal (4) poisoning. It is

intended to be an overall evaluation of the case, taking into account the most severe clinical features.<sup>13-14</sup>

## 2. Patients and Methods

### Patients

This study was conducted on 100 patients with acute hydrocarbons toxicity admitted to the Poisoning Center in the Alexandria Main University Hospital (AMUH). Patients were taken in consecutive order. All patients presented with recent history of intake or exposure to hydrocarbons (within the last 24 hours) was included in our study.

### Exclusion criteria

Patients with history of central nervous system, cardiac, pulmonary or renal diseases and admission after 24 hours of exposure.

### Methods

Patients with acute hydrocarbon toxicity admitted to the Poisoning center were subjected to full history taking, complete physical examination. The following measures were done for every patient included in the study on admission, every 24 hours and on discharge: Plain chest x-ray, Electrocardiogram (ECG) done by Cardimax (Fukuda Denish) and arterial blood gases (ABG) done by the blood gas analyzer GEM Primer 3500. Other laboratory investigations included: complete blood count (CBC) done by SYSMEX- KX21N, sodium (Na), potassium (K) (mEq/L) done by AVL 9180, blood urea nitrogen (BUN) & creatinine (mg/dL), Alanine aminotransferase (ALT) and aspartate aminotransferase<sup>15</sup> (IU/L) done by Hitachi 902. The reference values for ABG parameters are as follows: pH (7.35-7.45), PaCO<sub>2</sub> (35-45), PaO<sub>2</sub> (70-100), HCO<sub>3</sub> (22-26), SaO<sub>2</sub> (90-95). The reference values for the CBC were: Hemoglobin (12-17 g/dL), Leukocytic count (4-10.5 k/ $\mu$ L) and platelet count (150.0 - 450.0 k/ $\mu$ L).

The reference values for these lab tests are as follows: Sodium (135-145 mEq/L), Potassium (3.5-5.2 mEq/L), BUN (7-20 mg/dL), Creatinine (0.5-1.4 mg/dL), ALT (<35 IU/L), AST (<35 IU/L). An informed consent to participate in the study was taken from all the patients (if fully oriented) or from the relatives (if the patients were not oriented or younger than 18 years). The study was approved by the ethical committee of the faculty of Medicine, University of Alexandria.

All included patients were graded according to the Poison Severity Score (PSS)<sup>13</sup> to either: NONE (0): No symptoms or signs related to poisoning.



MINOR (1): Mild, transient, and spontaneously resolving symptoms

MODERATE (2): Pronounced or prolonged symptoms

SEVERE (3): Severe or life-threatening symptoms.

FATAL(4): Death.

Applying the PSS, it took into account only the observed clinical symptoms and signs and did not estimate risks or hazards on the basis of parameters such as amounts ingested. The PSS was applied according to the most severe symptomatology.<sup>13</sup>

All patients received the standard treatment of hydrocarbon toxicity. Gastric emptying or lavage, administration of activated charcoal and induction of emesis were avoided for risk of aspiration. The patients' clothing was removed and their skin was cleaned to prevent continued inhalation exposure. Bronchospasm was treated with selective beta 2 agonists and corticosteroids. Pneumonitis caused by hydrocarbon aspiration was not treated routinely with antibiotics unless signs of secondary infection, including the following were present: Fever after the first 48 hours, increasing infiltrate in chest radiograph and leukocytosis. Patients with CNS depression and impaired ventilation were indicated for endotracheal intubation, mechanical ventilation and chest physiotherapy.<sup>16-17</sup>

Patients' initial grading was correlated with patients' outcome. The outcome parameters included: need for ICU admission, mechanical ventilation (whether invasive or non-invasive) and the length of ICU and hospital stay, as well as hospital mortality.

### Statistical analysis:

The results were analyzed using SPSS ver. 15. ANOVA test was used to find the significance between the different grades of severity for the different outcomes.

### 3. Results

The age of the included patients ranged from 1.5 to 24 years with a mean of  $6.02 \pm 5.00$ . 58 patients (58%) were males and 42 patients (42%) were females.

Table (1) demonstrates the baseline characteristics of the enrolled patients.

Chest X-ray of patients on admission: On admission 95% of the patients had negative findings and 5% of the patients had positive findings. ECG findings of patients on admission: On admission 100% of the patients had negative findings.

### After 24 hours:

### Vital signs:

MAP, HR, Temperature and RR were significantly changed after 24 hrs.

### ABG:

Significant changes were noticed in pH, PaCO<sub>2</sub>, PaO<sub>2</sub> and O<sub>2</sub> saturation. There was no significant change in HCO<sub>3</sub>.

### Laboratory investigations:

CBC showed significant change only in white blood cell (WBC) count. Electrolytes had changed significantly in both Na<sup>+</sup> and K<sup>+</sup>. Regarding renal and liver functions, there were no significant changes.

### Chest x-ray:

Positive changes were seen in 31% of patients compared to 5% on admission.

### ECG:

No significant changes were observed.

Grading of the patients on admission according to PSS:

On admission, 32% of all patients (n=32) were graded as None (0), 50% (n=50) were graded as Minor (1), 14% (n=14) were graded as Moderate (2) and 4% (n=4) were graded as Severe (3).

### Length of hospital and ICU stay:

Length of hospital stay for all patients ranged from 1 to 9 days with a mean of  $1.65 \pm 1.28$ . For ICU admitted patients, the hospital stay ranged from 2 to 9 days with a mean of  $3.89 \pm 1.57$ . Their ICU stay ranged from 2 to 8 days with a mean of  $3.06 \pm 1.63$ .

### 4. Discussion:

Accidental hydrocarbon and particularly kerosene ingestion remains a serious contributor to childhood poisoning in the low socioeconomic groups, with a high incidence of morbidity and occasional mortality.<sup>18-19</sup> In our toxicology department, kerosene poisoning is ranked as the 3<sup>rd</sup> most common cause of admission, after "unidentified" substances and organ phosphorus compounds poisoning. In the year 2007 the number of patients admitted with hydrocarbons poisoning was 272.

The main causes of mortality in our study group were multiple organ failure (acute respiratory distress syndrome, arrhythmias, renal failure, consumptive coagulopathy and coma). This was secondary to respiratory failure and not to direct toxic insult. This was in agreement with what Nogue et al and Yu et al reported in their studies.<sup>20-21</sup>

**Table (1): Baseline characteristics of the study population.**

	Minimum	Maximum	Mean	SD
<b>Vital signs</b>				
<b>Mean Arterial Pressure (mmHg)</b>	68.00	96.00	78.27	6.59
<b>Heart rate (Beats/minute)</b>	75.00	130.00	106.55	9.54
<b>Temperature (Degrees)</b>	36.50	37.40	36.93	0.22
<b>Respiratory rate (Breath/minute)</b>	15.00	44.00	27.27	± 5.83
<b>Arterial Blood Gases</b>				
<b>pH</b>	7.32	7.52	7.41	0.04
<b>Carbon Dioxide Tension (mmHg)</b>	28.00	61.50	38.78	4.43
<b>Oxygen Tension (mmHg)</b>	53.00	98.00	90.48	9.62
<b>Bicarbonate (mmol/L)</b>	21.00	30.20	24.20	1.26
<b>O<sub>2</sub> Saturation (%)</b>	85.00	99.00	96.19	2.77
<b>Laboratory Investigations</b>				
<b>Complete Blood Picture</b>				
<b>Hemoglobin (g/dL)</b>	10.30	13.50	11.65	0.75
<b>Leucocytes (k/<math>\mu</math>L)</b>	4200.00	9300.00	6398.00	1204.03
<b>Platelets ((k/<math>\mu</math>L)</b>	160000	275000	210410.00	25809.75
<b>Electrolytes</b>				
<b>Sodium (meq/L)</b>	136.00	148.00	140.00	2.61
<b>Potassium (meq/L)</b>	3.60	4.4	3.99	0.19
<b>Renal functions</b>				
<b>Blood urea Nitrogen (mg/dL)</b>	8.00	16.70	16.70	8.00
<b>Serum Creatinine (mg/dL)</b>	0.60	1.20	0.88	0.16
<b>Liver functions</b>				
<b>AST* (IU/L)</b>	16.20	27.00	20.19	2.66
<b>ALT** (IU/L)</b>	16.50	25.60	20.34	2.29
<b>Chest X-ray</b>	<b>Negative cases</b>	95 (95.0%)	<b>Positive cases</b>	5 (5.0%)

\*AST= Aspartate Amino Transferase, \*\*ALT= Alanine AminoTransferase

**Table (2): Relation between hospital and ICU stay and PSS grading:**

	Grade				<sup>2</sup> (p)
	None	Minor	Moderate (n = 14)	Severe (n = 4)	
<b>Hospital stay</b> Mean $\pm$ SD	1.00 $\pm$ -	1.26 $\pm$ 0.44	3.50 $\pm$ 0.65	5.25 $\pm$ 2.99	68.529 ( $<0.001^*$ )
<b>ICU stay</b> Mean $\pm$ SD	-	-	2.50 $\pm$ 0.65	5.00 $\pm$ 2.58	4.042 (0.044 <sup>*</sup> )

\*p&lt;0.05 = significant

**Table (3) Distribution of the studied cases according to outcome.**

Outcome	No.	%
<b>Complete recovery</b>	97	97
<b>Need for MV</b>		
Invasive MV	13	13.0
Non invasive MV	0	0
<b>Need for ICU</b>	18	18
<b>Hospital mortality</b>	3	3

**Table (4) Relation between chest X-ray on admission and outcome parameters:**

Table 4. Relation between chest x-ray on admission and outcome parameters					
	Admission Chest x-ray				FEp
	Negative		Positive		
	No.	%`	No.	%	
<b>Complete recovery</b>					
Yes	93	97.9	4	80.0	0.144
<b>ICU admission</b>					
Yes	13	13.7	5	100.0	<0.001*
<b>MV</b>					
Yes	10	10.5	3	60.0	0.015*
<b>Hospital mortality</b>					
Yes	2	2.1	1	20.0	0.144

**Table (5): Correlation between PSS grading of patients on admission and outcome.**

Outcome	Grade								MCp
	None		Minor		Moderate		Severe		
	No.	%	No.	%	No.	%	No.	%	
Complete recovery									<0.001*
No	0	0.0	0	0.0	0	0.0	3	3.0	
Yes	32	32.0	50	50.0	14	14.0	1	1.0	
FEp <sub>1</sub>			-		-		0.001*		
FEp <sub>2</sub>			-		<0.001*				
FEp <sub>3</sub>					0.005				
ICU admission									<0.001*
No	32	32.0	50	50.0	0	0.0	0	0.0	
Yes	0	0.0	0	0.0	14	14.0	4	4.0	
FEp <sub>1</sub>			-		<0.001*		<0.001*		
FEp <sub>2</sub>			<0.001*		<0.001*				
FEp <sub>3</sub>					-				
Need for MV									<0.001*
No	32	32.0	50	50.0	5	5.0	0	0.0	
Invasive	0	0.0	0	0.0	9	9.0	4	4.0	
Non Invasive	0	0.0	0	0.0	0	0	0	0.0	
MCp <sub>1</sub>			-		<0.001*		<0.001*		
MCp <sub>2</sub>			<0.001*		<0.001*				
MCp <sub>3</sub>					0.278				
Mortality									<0.001*
No	32	32.0	50	50.0	14	14.0	1	1.0	
Yes	0	0.0	0	0.0	0	0.0	3	3.0	
FEp <sub>1</sub>			-		-		0.001*		
FEp <sub>2</sub>					<0.001*				
FEp <sub>3</sub>					0.005*				

MCp: p for Monte Carlo test, FEp<sub>1</sub>: p for Fisher Exact test between None and other grades, FEp<sub>2</sub>: p for Fisher Exact test between Minor and other grades, FEp<sub>3</sub>: p for Fisher Exact test between moderate and severe, \*: Statistically significant at p = 0.05

Several studies related hydrocarbons toxic potentials and their toxicity clinical course to different factors, such as Physical characteristics e.g. (volatility is directly related to the incidence of aspiration while viscosity and surface tension are inversely related to it), and chemical characteristics e.g. (aromatic, aliphatic or halogenated hydrocarbons). Cobaugh et al reported in his study that hydrocarbons that are absorbed systemically and those with low viscosities are associated with higher hazard factors.<sup>22-23</sup> We could not count on these factors to triage our patients or to predict their outcomes because all of the patients included in our study were exposed to kerosene, gasoline and paint

thinner which are aliphatic, highly volatile, with low surface tension and low viscosity hydrocarbons meaning that they all share the same physical and chemical characteristics. Unfortunately in our department we hardly get any case intoxicated by hydrocarbons of high systemic absorption such as aromatic and halogenated hydrocarbons.

Chest X-ray was previously known to be the most important investigation requested for patients with hydrocarbons ingestion for its diagnostic and prognostic value. Yet recent studies such as in Seymour et al and David et al proved that its correlation with physical examination may be poor as initial radiograph in symptomatic patients maybe

deceptively clear and mild radiographic changes do not guarantee mild symptoms. Also admission chest X-rays contributed little to the management and the course of the illness.<sup>23-24</sup> In our study, chest X-ray on admission showed significant correlation with admission to the ICU and need for MV, while correlation was insignificant to complete recovery and hospital mortality. On the contrary, Anas et al. reported that abnormal initial radiographs in asymptomatic patients were not necessarily associated with a complicated course, still he agreed with the present study that radiographs were inferior to clinical signs for triage of patients with acute hydrocarbons toxicity.<sup>25</sup>

At Ain Shams University, Gamaluddin et al<sup>26</sup> conducted a study which appeared to have a principle close to ours. His goal was to derive a practical triage decision rule for use at primary health care facilities for early clinical identification of hydrocarbon ingestion/aspiration cases that will require the treatment and support services available at facilities offering higher levels of care (Ain Shams University Poison Control Centre). He depended on Integrated Management of Childhood Illness (IMCI) clinical algorithm to categorize his patients (according to their outcome) into 2 groups, resource requiring group and non-resource requiring group. Their study suggested a triage decision rule based on the presence of wheezing, altered consciousness or a rapid respiratory rate within 2 hours of exposure.

In our study, we used PSS System to categorize our patients into 4 groups (none, minor, moderate and severe) according to their clinical symptoms and their initial chest x-ray findings. We applied PSS on patients who ingested kerosene admitted to our poison centre in order to define those patients who were in need for ICU admission or expected to have a complicated course. Our goal was to correlate between their grades and their outcomes in order to apply PSS in the future for triage decision making concerning patients admitted with hydrocarbons poisoning.

Gupta et al<sup>27</sup> used a weighted scoring system based on clinical features and severity of illness to predict the outcome of children with kerosene poisoning. The scoring system depended on the presence or absence of: (1) Fever, (2) Severe malnutrition (3) Respiratory distress (with or without cyanosis) and (4) Neurological symptoms (with or without convulsions). The total score of each patient ranged from 0 to 10. He concluded that a score of 4 or more was found to be associated with prolonged hospital stay and complications and that the risk of dying increased if the score was equal to or more than 8.

We chose to use PSS on our patients to be more comprehensive. Though the main system targeted in hydrocarbons poisoning is usually the respiratory system still there are other systems that could be affected and deteriorate the patients' condition accordingly, e.g. syncope or arrhythmia which are the results of cardiac sensitization to catecholamines. Also the PSS system appears to represent each system involved in a sequential progression, e.g. in the respiratory system, it starts with no symptoms progressing to airway irritation followed by dyspnea and hypoxemia ending with the most severe form of cyanosis and respiratory depression. When we applied this scoring system, we concluded that patients admitted with grades 2 were more liable to develop complications and thus prolonged hospital stay was predicted. This is why we recommended immediate ICU admission for those cases.

The PSS has been elaborated, tested, and gradually revised during a project running 1991-1994. The concordance in grading the severity increased during the study period, and in the last phase there was an acceptable concordance among fourteen poisons centers in 80% or more of the cases. It is intended to be an overall evaluation of the case, taking into account the most severe clinical features.<sup>13-14</sup>

Pach et al assessed the concordance in severity grading when using the PSS versus specific grading scales. Severity grading was performed in all cases using both the PSS and special grading scales developed by the poison center in Krakow. An acceptable concordance between the PSS and these locally developed grading scales was found in the majority of cases but for specific poisons, like carbon monoxide, some modifications and additional criteria may be justified. The authors concluded that further studies to test the reliability of the PSS are encouraged.<sup>28</sup>

Davies et al<sup>29</sup> study showed that Glasgow Coma Score (GCS) and the PSS were similarly effective at predicting outcome of acute Organophosphorus poisoning and to assess whether patients at high risk of death could be identified accurately using clinical parameters soon after hospital admission. He concluded that patients presenting with a GCS  $\leq 13$  or PSS 2 need intensive monitoring and treatment. Although dealing with different toxins, we agreed with Davies studies in the part of his conclusion concerned with the PSS, as patients presented with grade 2 in our study needed immediate ICU admission for better treatment resources and mechanical ventilation. We did not use the GCS because this would have definitely resulted in underestimation of the patients' actual situation as hydrocarbons toxicity mainly affects respiratory



system and GCS is a neurological scale. In addition, hydrocarbon CNS toxicity is usually affected secondary to respiratory failure. Thus it would take a relatively long time for the GCS to deteriorate in a patient presented with the life threatening grade of PSS.

Sam et al<sup>30</sup> evaluated the effectiveness of various severity and prognostic scales including the Acute Physiology and Chronic Health Evaluation II (APACHEII), GCS and PSS in evaluating acute Organophosphate poisoned patients at the time of admission. The mean hospitalization period and outcome of poisoning were significantly influenced by the PSS scores but not by the APACHEII or GCS scores. There was also a significant correlation found between the PSS and mortality, between the PSS grades and the need for ventilation and between PSS and incidence of intermediate syndrome (complications). Likewise, our results showed significant relation between PSS and hospital mortality, admission to the ICU, mechanical ventilation and mean hospital and ICU stay.

Pach J et al had also reported that the PSS is useful in assessing severity on the basis of observed clinical signs and symptoms (at their maximum), but does not take into account potential risks or plasma/serum concentrations.<sup>28</sup>

CEVIK et al<sup>31</sup> had a study to evaluate the relationship between the Poisoning Severity Score (PSS) and carboxyhaemoglobin (COHb) levels in patients with carbon monoxide poisoning (COP) using outcome as the measure. He found that COHb levels according to outcome were not different between PSS grades. He concluded that PSS is a reliable severity score for COP cases. However, he also recommended modifying the current PSS and for its future application to predict severity, management and outcome.

Ciszowski et al<sup>32</sup> used PSS to determine relations between the clinical state and the severity of liver damage comparing to the amount of ingested paracetamol, time since ingestion and serum concentration of paracetamol with patients after acute intoxication with this drug. The general clinical state was determined using the Poisoning Severity Score (PSS). Statistically significant positive correlation was found between the ingested dose of paracetamol comparing to the severity of poisoning, the severity of liver damage, levels of aminotransferases and bilirubin. A positive correlation between time since ingestion of paracetamol to hospitalization and the gravity of poisoning according to PSS scale was also statistically significant. A paracetamol concentration measured during admission to the hospital had no influence on either the clinical state of patient or the severity of liver damage.

In order to discuss different scores used to predict toxic related mortality in acute poisoning, Hantson et al<sup>33</sup> conducted a study which included poisoning severity scores presented by the PSS, general scores such as APACHE II, SOFA (The Sequential Organ Failure Assessment score) and SAPS (Simplified Acute Physiology II scores), neurological scales such as GCS and AVPU (Alert Verbal Pain Unconscious). They concluded that general scores lack treatment measures considerations, GCS and AVPU would be misinterpreted for fluctuating conscious level with some toxins and sedations and finally, though PSS is an outcome score yet it cannot be used to predict mortality in the ICU admitted patients, and is probably helpful to grade retrospectively the severity of poisoning. In our study we used PSS for initial grading of all patients on admission not retrospectively and the results showed the ability of the score to predict outcome including hospital mortality but not mortality in ICU admitted patients.

## 5. Conclusion:

According to this study, the PSS could be a useful tool to predict outcome in patients admitted with hydrocarbon toxicity as the different grades of the PSS system had significant correlation with patients' outcome. Patients presenting with hydrocarbons with a PSS of 2 could be directly admitted to the ICU for possible need of MV because of associated unfavorable outcome.

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**Assessing Advantages and Disadvantages of E-learning**<sup>1</sup> Molouk Gharibpanah, <sup>2</sup> Azita Zamani<sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran

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**Abstract:** Distance education is a method of education in which the learner is physically separated from the teacher and the institution sponsoring the instruction. It may be used on its own, or in conjunction with other forms of education, including face-to-face instruction. In any distance education process there must be a teacher, one or more students, and a course or curriculum that the teacher is capable of teaching and the student is trying to learn. The contract between teacher and learner, whether in a traditional classroom or distance education, requires that the student be taught, assessed, given guidance and, where appropriate, prepared for examinations that may or may not be conducted by the institution. This must be accomplished by two-way communication. Learning may be undertaken either individually or in groups; in either case, it is accomplished in the physical absence of the teacher in distance education. Where distance teaching materials are provided to learners, they are structured in ways that facilitate learning at a distance.

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**Keywords:** E-learning, distance education

**Introduction:**

When the standardization and the requirements for training by the third millennium will be talking, unconscious form, design and construction to provide context and use tools and indicators to teaching the principles of community-based knowledge to the mind is centered. . No doubt these requirements and identify the correct tools and proper utilization of their functions according to accelerate the development expected in the knowledge-based information society will be effective. Such concerns and problems that any country in its development plans in motion to the information becoming a knowledge based society means a society would be faced with the centrality of knowledge, Dealing with existing tools and how these tools are used.

Led the way when dealing with those massive training programs available to speak to the technological tools that we expect to occur that planners and decision makers that planners and decision makers of large structures, especially university education according to the image Access to the development of community information are available on these tools are selected and used.

Massive wave of data produced in today's world it nicknamed the "information age" has all day and through various means of communication in the world will move on its size are added. Other hand, as we're not the world witnessed the development of the role of information communication devices transporting feedback fast and absorb the information around the world, we forget

Therefore, information and communication as the main lever or two important move in developing wings, we learn. Meanwhile, proper utilization of the capacities of these two valuable and effective indexes

in the general development concept for any society and the principles of a critical need is considered. With a view to clarifying this issue can be paid in the best way to create a platform for developing data standards and access to a knowledge based society, what really can be. To achieve a clear and practical answer in this area before all the existing definitions and indicators mentioned placed.

**What is Distance Education?**

Distance education is education designed for learners who live at a distance from the teaching institution or education provider. It is the enrollment and study with an educational institution that provides organized, formal learning opportunities for students. Presented in a sequential and logical order, the instruction is offered wholly or primarily by distance study, through virtually any media. Historically, its predominant medium of instruction has been printed materials, although non-print media is becoming more and more popular. It may also incorporate or make use of videotapes, CD or DVD ROM's, audio recordings, facsimiles, telephone communications, and the Internet through e-mail and Web-based delivery systems. When each lesson or segment is completed, the student makes available to the school the assigned work for correction, grading, comment, and subject matter guidance by qualified instructors. Corrected assignments are returned to the student. This exchange fosters a personalized student-instructor relationship, which is the hallmark of distance education instruction.

Historically, most distance education courses were vocational in nature, but today courses are offered for academic, professional, and avocational purposes for students of all ages. There are numerous specialized programs, such as those for blind persons and for parents of small children with hearing impairments. Distance education is available in practically any field, from accounting to zoology. Courses are offered in gemology, high school diploma, journalism, locksmithing, child day care management, yacht design, and many fascinating subjects.

Distance education courses also vary greatly in scope, level, and length. Some have a few assignments and require only a few months to complete, while others have a hundred or more lesson assignments requiring three or four years of conscientious study.

Since 1890, more than 130 million Americans have studied at DETC member institutions, including Franklin D. Roosevelt, Walter P. Chrysler, Walter Cronkite, Barry Goldwater, Charles Schulz, and many other distinguished alumni of DETC members.

Unlike most distance education courses offered by traditional colleges and universities that are semester and classroom oriented, with courses offered by most of the DETC-accredited institutions you can study any time and anywhere. Distance education is especially suited for busy people who wish to increase their knowledge and skills without giving up their jobs, leaving home, or losing income. You learn while you earn. Many courses provide complete vocational training; others prepare you for upgrading in your present job, without losing wages, experience or seniority. You receive individual attention, and you work at your own pace.

#### **Benefits of Distance Learning:**

Benefits and opportunities that distance education provides, include:

- training a wide range of audiences.
- meet the needs of students and students who can not attend in place.
- Possible connection between students and students with cultures, beliefs and experiences are different.
- Benefiting from coaches and speakers who do not live in the country.

#### **Educational methods in distance learning:**

Today, under the new system replaced the traditional systems of learning and learning week (ie tutoring methods, lectures) are:

##### **- Multimedia courses:**

These courses and widely used elements of image, communication, graphics and simulated components, animation and communication elements for guidance and tips, and talk back on course and curriculum issues are held.

##### **- Enhanced communication mechanisms:**

The mechanism of any texts simultaneously, and asynchronous audio-visual communications to protect you. This case allows students to practice on topics learned will give.

##### **- Written test:**

thus, question and test via a distributed communication network, are corrected and returned. These exams through video conferencing support and runs.

##### **-Virtual Seminar:**

thereby different groups of students in different geographical environments linked together makes.

##### **- Collaborative virtual laboratories:**

the laboratory of the Group's activities are supported. Workshops such as software engineering.

##### **-Smart academic factors:**

academic factors that inform intelligent, support and guidance students pay.

#### **Remote educational tool:**

distance learning tools and supplies various uses. These tools in four main courses are:

##### **A - Audio Tools:**

Audio tools include training such as two-way interactive telephone, video conference, shortwave radio and a strain of tools such as audio tape and radio.

##### **B - Image tools:**

including slides, films, video tapes and video conferences.

##### **C - Data:**

computers as electronic data are sent and received. Because the data word description for a wide range of educational tools is used.

Computer applications for distance education are varied and include the following:

- 1- Training to Computer Management.
- 2 - Computer Assisted Instruction.
- 3 - through PCs.
- 4 - e-mail, telegraph, computer conference and the World Wide Web simultaneously.

##### **D - Print:**

The main element of distance education programs, particularly in the exchange and delivery system information tools are considered.



### **Key factors in the process of distance education:**

the process of remote training, the following factors contribute:

- Students:

Regardless of educational content, role and main element in the learning process students are responsible.

- Coaches and Teachers:

Success depends on a lot of educational activities the ability, skills and knowledge are the coaches and professors.

- Facilitators of communication:

Facilitator bases, as the bridge between students and mentors are. Must base expectations of teachers and educational needs of students and service coordination and communication to create.

- Support staff:

One of the important pillars of any development of distance education programs, by development group finds. Operational support staff such as student registration, copy and distribute their resources, order textbooks, security and copyright, and are responsible for the report.

- Management:

The group decision makers, builders and judges are considered to be educational and should be considered among the factors above, establish the correct relationship formation.

### **Advantages of E-Learning: Benefits of E-Learning**

#### **What are the e-Learning advantages and what are the disadvantages?**

This is an important question to consider before making a final decision whether to enroll online learning or not.

It is known that Online Education with its e-learning software tools offers a new experience but does it work for everyone?

This experience may not be for everyone, professionally and personally, however it does have its strong point, advantages, and unique feature worth knowing.

This article reviews and discusses the best features it provides -

#### **ELearning Benefits – E-Learning Advantages:**

##### **1. Accessibility**

Online classes are very attractive to some people because of their unprecedented accessibility: virtual classes in any online institution can be accessed from anywhere on the planet. The internet also allows much greater time flexibility, though it does not mean an absolute absence of submission and exam dates. For many, online education means – being able to study an advanced degree during breaks at work or at night from home.

##### **2. Geographic diversity – Ease of accessibility**

Many universities are renowned for their diversity. But online institutions create unprecedented possibilities in this area. The e-learning technology they use enables accessing classes online – It is possible for any person on the planet to study in any online course (and online school/university) without the need to travel and reside abroad. For this reason diversity can be far greater than in any traditional university.

##### **3. Classroom Size and Manageability**

Traditional education cannot afford to have very large classes, especially in advanced degrees. Then e-learning means and tools answer this need – Online education allows a greater number of students to be accepted to their desired courses since managing students online is easier.

##### **4. Self-Paced Studies**

The internet allows an unprecedented degree of freedom in pacing and spacing one's studies. This is a great appeal to those who like a lot of freedom and have learning rhythms which do not align with traditional campus life.

##### **5. Learning tools and means**

e-Learning offers different learning experience – It is a new technology based on standard means and tools such as – videos, e-books, online interactive means and activities. One may even select instructional material and work their own way/level to their degree.

##### **6. Asynchronous Communication**

Another advantage of e-learning methods is the use of asynchronous communication. Asynchronous communication is a communication through such online technology as email and online message

boards.

Communicating online is easier for those who cannot express themselves face to face. It also allows time to think before responding, which you do not really have in a classroom discussion.

## 7. Biased Interactions

There tends to be less bias online, because the setting is less direct and intimate. For many, this is another great plus.

## Conclusion:

Technology transports information, not people. Distances between teachers and students are bridged with an array of familiar technology as well as new information age equipment. What sets today's distance education efforts apart from previous efforts is the possibility of an interactive capacity that provides learner and teacher with needed feedback, including the opportunity to dialogue, clarify, or assess. Advances in digital compression technology may greatly expand the number of channels that can be sent over any transmission medium, doubling or even tripling channel capacity. Technologies for learning at a distance are also enlarging our definition of how students learn, where they learn, and who teaches them. No one technology is best for all situations and applications. Different technologies have different capabilities and limitations, and effective implementation will depend on matching technological capabilities to education needs.

Distance education places students and their instructors in separate locations using some form of technology to communicate and interact. The student may be located in the classroom, home, office or learning center. The instructor may be located in a media classroom, studio, office or home.

The student may receive information via satellite, microwave, or fiber optic cable, television (broadcast, cable or Instructional Television Fixed Services (ITFS)), video cassette or disk, telephone - audio conferencing bridge or direct phone line, audio cassette, printed materials - text, study guide, or handout, computer - modem or floppy disk, and compressed video. Recent rapid development of technology has resulted in systems that are powerful, flexible, and increasingly affordable. The base of available information technology resources is increasing with dramatic speed. Much has been

learned about connecting various forms of technology into systems, so that the ability to link systems is growing. Most distance learning systems are hybrids, combining several technologies, such as satellite, ITFS, microwave, cable, fiber optic, and computer connections.

Interactivity is accomplished via telephone (one-way video and two-way audio), two-way video or graphics interactivity, two-way computer hookups, two-way audio. Interactivity may be delayed but interaction provided by teacher telephone office hours when students can call or through time with on-site facilitators. Classes with large numbers of students have a limited amount of interactivity. Much of the activity on computer networks is on a delayed basis as well. Possibilities for audio and visual interaction are increasingly wide.

In the earlier days of distance learning, it was most common to see distance learning used for rural students who were at a distance from an educational institution. The student might watch a telecourse on a television stations, read texts, mail in assignments and then travel to the local college to take an exam. This model is still in use, but as the technology has become more sophisticated and the cost of distance learning dropped as equipment prices dropped, the use of distance education has increased.

High front-end costs prevented an early widespread adoption of electronically mediated learning. Distance learning has been aggressively adopted in many areas because it can meet specific educational needs. As the concept of accountability became accepted and laws required certain courses in high school in order for students to be admitted to state colleges, telecommunications was examined as a way to provide student access to the required courses. Many rural school districts could not afford the special teachers to conduct required courses. Distance education met this need by providing courses in schools where teachers were not available or were too costly to provide for a few students. It also fulfilled a need for teacher training and staff development in locations where experts and resources were difficult to obtain. These systems link learner communities with each other and bring a wide array of experts and information to the classroom.

The key to success in distance learning is the teacher. If the teacher is good, the technology can become almost transparent. No technology can overcome poor teaching which is actually exacerbated in distance education applications. When skilled

teachers are involved, enthusiasm, expertise, and creative use of the media can enrich students beyond the four walls of their classroom.

Teachers need training in the system's technical aspects and in the educational applications of the technology. Areas for assistance include the amount of time needed to prepare and teach courses, how to establish and maintain effective communication with students, strategies for adding visual components to audio courses, ways to increase interaction between students and faculty, planning and management of organizational details, and strategies for group cohesion and student motivation.

The interchange of ideas requires different communication methods than in conventional classrooms: information technologies are predominantly visual media, rather than the textual and auditory environment of the conventional classroom, the affective content of mediated messages is muted compared to face-to-face interaction, and complex cognitive content can be conveyed more readily in electronic form because multiple representations of material (e.g., animations, text, verbal descriptions, and visual images) can be presented to give learners many ways of understanding the fundamental concept.

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**Effect of closed versus open Suction System on Cardiopulmonary Parameters of Ventilated Neonates**Gehan M. Khamis<sup>1</sup>, Omnia G.Waziry<sup>1</sup>, Abdel-Halim A. Badr-El-Din<sup>2</sup>, Magda M. El- Sayed<sup>1</sup><sup>1</sup> Department of Pediatric Nursing, Faculty of Nursing, University of Alexandria, Egypt<sup>2</sup> Department of Pediatrics, Faculty of Medicine, University of Alexandria, Egypt

**Abstract:** Removal of airway secretion is required in many neonates in the intensive care setting, and the process is most critical with respiratory problems. Clearance of secretions is essential in the mechanically ventilated neonates, because these neonates breathe slowly through an artificial airway. So, accumulation of secretions can lead to airway occlusion, serious physiological abnormalities and even death. Therefore, suctioning is essential for removing secretions and maintaining airway patency. This study aimed to determine the effect of closed versus open suction system on the cardiopulmonary parameters of ventilated neonates. The study was conducted at the Neonatal Intensive Care Unit at El-Shatby Maternity University Hospital in Alexandria. A Convenient sample of 60 neonates was randomly assigned into two groups. Thirty neonates (group A) were suctioned by closed suction system, and the other 30 neonates (group B) were suctioned by open suction system. The results revealed that that the closed suction system was more effective in maintaining the oxygen saturation, capillary refill and has less negative impact on the occurrence of cardiac arrhythmia as cardiopulmonary parameters. Other physiological parameters were also better maintained with closed than with opened suction system.

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**Keywords:** suction system, cardiopulmonary, neonates, airway patency.

**1. Introduction**

Immediately after birth, the neonate faces enormous tasks of homeostasis and adaptation to extrauterine life. These tasks include the change from fetal to extrauterine circulation, establishment of respiration, temperature regulation, digestion, and elimination (Ashwill et al, 2002). The major function of the respiratory system is to provide oxygen for metabolism and to remove carbon dioxide. Without an adequate exchange of oxygen and carbon dioxide, the metabolic demands of tissues would remain unfulfilled and body systems would rapidly fail. When oxygenation and ventilation are inadequate mechanical ventilation may be used (William et al., 2000 & Newmarch 2006).

Mechanical ventilators are devices that can create a flow of gas into and out of the lungs by the manipulation of airway pressures. The main goal of the ventilator may be achieved by improving alveolar ventilation, arterial oxygenation, increasing lung volume and reducing work of breathing (William et al, 2000). Mechanical ventilation is the mainstay of management of a variety of conditions affecting the neonate. However, there are a number of documented complications associated with this procedure, which include hypoxemia, bradycardia and increase in secretion formation in the lower tracheobronchial tree (Pritchard et al, 2003), Morton et al, 2005 & Newberry, 2005). Therefore, Suctioning becomes paramount for removing secretions and maintaining patency which

is the major goal of respiratory care to ensure adequate alveolar ventilation (Morton et al, 2005)

Endotracheal suctioning (ES) is usually performed through open suction system (OSS) where the patient is disconnected from the ventilator and the suction catheter is introduced into the endotracheal tube. (Maggiore et al, 2002 & Urden et al, 2004). Although tracheal suctioning is frequently performed to clear airway secretion, it is associated with a number of complications including disturbance in cardiac rhythm, hypoxemia and tissue hypoxia, infection, and development of ventilator associated pneumonia (VAP) (Almgren et al, 2004, Baun et al, 2005, Jongerden et al, 2007 & El Masry et al, 2005).

An advanced suctioning technique namely closed suction system (CSS) has been introduced into clinical practices with the aim of preventing or reducing the undesirable side effects of OSS. (Tan et al, 2005), Gulielminotti et al, 1998 & Zahran, 2001) Closed endotracheal suction is performed with the use of specially designed endotracheal tube included in the ventilatory circuit, where the suction catheter is usually introduced into airway without disconnecting the patient from the ventilator. The risk of complications may therefore be reduced by minimizing the interference with ventilation during the procedure. (Thelan et al, 1998 & Cereda et al, 2001) In a study done by Tan et al. (2004) to compare between OSS and CSS, they reported that CSS was associated with more hemodynamic



stability, and even eliminated suction related complications (Tan et al, 2005). In another study done by El Masry et al. (2005), who conducted a study about the impact of CSS on mechanical ventilator performance, they concluded that positive end expiratory pressure (PEEP) markedly decreased with increased peak flow and respiratory rate when the patient was suctioned with OSS while CSS doesn't cause mechanical ventilator malfunction (El Masry et al, 2005).

The Pediatric nurse has an important role not only in the management of neonatal airway, but also in preventing complications. She is always responsible for monitoring respiratory status and assessing the need for suctioning secretions, performing suction and evaluating the outcome. In this respect, it can be concluded that nursing care of artificial airway including suctioning of secretion is very important and life saving. (Ashwill et al, 2002 & Williams et al, 2000). She also must be aware of the different methods of suction. Closed suction system is not adequately investigated in Egypt.

#### **Aim of the Study:**

The aim of the study is to determine the effect of closed versus open suction system on the cardiopulmonary parameters of ventilated neonates.

## **2. Material and Methods**

### **Material**

**Research Design:** It is a quasi experimental study.

### **Setting**

The study was conducted at the Neonatal Intensive Care Unit at El-Shatby Maternity University Hospital in Alexandria.

### **Subjects**

A convenient sample of 60 neonates who were mechanically ventilated and free from congenital heart diseases was included in the study. The neonates were randomly assigned into two groups. Thirty neonates (group A) were suctioned by closed suction system, and the other 30 neonates (group B) were suctioned by open suction system.

### **Tool**

#### **Assessment Sheet:**

**An assessment sheet was developed after thorough review of the related literature. It was comprised of three parts:**

#### **Part I:**

- **Neonate's data** which included:-
  - Neonate's biodemographic data, such as age, sex, Diagnosis and date of admission.
  - Neonate's birth weight, type of labor, gestational age.
  - Duration of intubation, endotracheal tube size and suction catheter size.

#### **Part II:**

- **Ventilator Data** which included:
  - Mode of Ventilation, Tidal Volume (Vt), Fraction of Inspired Oxygen (FIO<sub>2</sub>), Positive End Expiratory Pressure (PEEP), Peak Inspiratory Pressure (PIP), Inspiratory Time (Ti), Expiratory Time (Te), Inspiratory to Expiratory Ratio (I / E Ratio) and Flow Rate (FR) .

#### **Part III:**

- **Cardiopulmonary parameters** which included:-
  - Heart rate (HR), Respiratory Rate (RR), Capillary Oxygen Saturation (SPO<sub>2</sub>), Capillary refill time, Temperature and Cardiac arrhythmia.

### **Methods**

The data were collected during the period from July 2006 to March 2007.

### **Methods of Data Collection**

- 1- An official approval for conducting the study was obtained from the responsible administrative personnel.
- 2- The assessment sheet of the study was developed after thorough review of the related literature.
- 3- A pilot study was done on 5 neonates to test the applicability of the tool; these five neonates were excluded from the sample.
- 4- Neonate's data were collected for each neonate in both groups A and B using part (I) of the assessment sheet tool.
- 5- Ventilator data were obtained immediately before the suction procedure.
- 6- Physiological parameters were obtained immediately before the suction procedure
- 7- Cardiopulmonary parameters were obtained through pulse oximetry for both groups before the suction to obtain the baseline data.
- 8- Tracheal suctioning was performed only when there was a clinical need.
- 9- The following considerations were followed for both groups:
  - A) -Suction Catheter was selected according to the endotracheal tube size
  - B) -Negative suction pressure was 60-80mmHg, it was applied intermittently and only during catheter withdrawal while simultaneously rotating the catheter.
  - C) Hyperoxygenation of the neonate was performed before, during and after suction through the ventilator by increasing fraction inspired oxygen (FIO<sub>2</sub>) 10-20% above the baseline data.<sup>(19)</sup>
  - D) After suction, gradual decrease of FIO<sub>2</sub> to the pre suction level.

10- Suction was carried out after ensuring that the neonate wasn't hypoxic at the time of suction as follows:

11-

**For closed suction system (Neonates of Group A)**

- The suction catheter was continuously placed between the endotracheal tube and Y piece of the ventilator

- The suction catheter was inserted into the endotracheal tube *without disconnection* from the ventilator for 10-15 seconds and repeated 3 times with hyper oxygenation.

**For open suction system (Neonates of Group B)**

-The endotracheal tube was *disconnected* at Y piece from the ventilator.

-The suction catheter was inserted into the endotracheal tube for 10- 15 seconds and repeated 3 times with hyper oxygenation.

-The endotracheal tube was reconnected at Y piece to the ventilator.

11- Ventilator parameters were obtained for each neonate of both groups A and B immediately after suctioning procedure and 10 minutes later.

12- Physiological and cardiopulmonary parameters were obtained immediately and after 10 minutes of suctioning for each neonate in both groups.

13- Heart rate, SPO<sub>2</sub> and cardiac rhythm were monitored by using a pulse oximeter and capillary refill was done by pressing the neonate's forehead.

**Statistical Analysis:**

After data were collected, they were coded and transferred into specially designed formats so as to be suitable for computer feeding. Following data entry, checking and verification processes were carried out to avoid errors during the data entry. Frequency analysis, cross tabulation and manual revision were all used to detect any errors. The SPSS (version 12) statistical program was utilized for both data presentation and statistical analysis of the results.

**The following statistical measures were used:**

- 1- Descriptive measures included: Percentage, mean, standard deviation.
- 2- Fisher exact test, Z test, ANOVA test, was used for test of significance.
- 3- The level of significance selected for this study was P less than 0.05

**3. Results**

Table (1) illustrates biodemographic characteristics of the neonates in relation to age, sex, birth weight and gestational age. It was found that

slightly more than half of the neonates who were suctioned by the closed system (53.5%) and 70% of the neonates who were suctioned by the open system were less than one week of age. Moreover, the mean ages of closed and open suction groups were  $9.73 \pm 8.88$  and  $7.63 \pm 10.25$  days respectively. Males constituted 60% of neonates of closed suction group and 50% for those who had open suction. It is observed from the table that 43.30% of neonates of both closed and open suction groups were very low birth weight i.e. weight < 1500 gm with the mean birth weights for both closed and open suction groups were  $1578.33 \pm 718.077$  and  $1597.83 \pm 635.219$  gm respectively. Slightly more than three quarters of neonates of closed suction group (76.70%) and 83.30% of the open suction group were preterm i.e. gestational age less than 37 weeks.

Characteristics of the neonates regarding type of labor, duration of intubation, tracheal tube and suction catheter size are presented in table (II). Sixty percent of the closed suction group and slightly more than three quarters of the open suction group (76.7%) were delivered by cesarean section.

Concerning the duration of intubation, 43.30% of the closed suction neonates and 73.30% of open suction neonates were on mechanical ventilator for a period of less than one week. Furthermore, fifty percent of both closed and open suction neonates had endotracheal tube size 3 French. All neonates of closed suction group (100%) and the majority of open suction group (83.30%) were suctioned with catheter size of 6 French.

Table (III) shows distribution of neonates according to their diagnosis for closed and open suction groups. It was clear from the table that most of the neonates of both groups had hyaline membrane disease (80% and 96.7% respectively). Two thirds of the neonates of closed suction group (66.7%) and 70% of the neonates of open suction group had pneumonia.

Table (IV) clarifies the comparison of chest assessment between closed and open suction groups. It was clear from the table that immediately after suction, only 40% of neonates of closed suction group had crackles compared to 63.3% of open suction group. Ten minutes after suction, only one neonate of closed suction group had crackles (3.3%) compared to 70% of neonates of open suction group and the difference was statistically significant. ( $P=0.000$ )

Regarding wheezes, it was observed that 43.3% of the neonates of closed suction group had wheezes before suction which declined to 10% only immediately after suction. On the other hand, 33.3% of the neonates of open suction group who had wheeze before suction declined to 23.3%. Ten

minutes after suction, further decrease was found in closed suction group as 6.7% only had wheezes, while in the open suction group wheezes increased again to 26.7%. Statistical significant difference was found between both groups 10 minutes after suction.

Table (V) compares between closed and open suction groups of neonates according to their physiological parameters. As the table shows, 60% of the neonates of the closed suction group who had heart rate within the normal range before suction (120-140) increased to 76.6% immediately after suction while, the 26.7% of the neonates of open suction group who had heart rate within normal range showed slight increase (33.3%) immediately after suction. Ten minutes after suction, further increase in the percentage was found among the closed suction group (83.3%) while, the other group showed slight decline (23.3%).

The frequency of bradycardia remained the same in the closed suction group, where only one neonate had bradycardia either immediately after suction or 10 minutes later (3.30%), while the incidence of bradycardia increased among the neonates of open suction group from 3.30% to 26.70% immediately after suction and 60% ten minutes after suction. Statistically significant difference was found between both groups immediately after suction ( $P=0.006$ ).

Regarding the temperature, it was observed from the table that 16.37% of neonates of both closed and open suction groups had temperature below normal range ( $<35^{\circ}\text{C}$ ) before suction. Immediately after suction, this percent of neonates decreased among the closed suction group to 13.30%, while, the percentage increased to 26.70% for neonates of open suction group. Ten minutes after suction, further increase was found among the neonates of open suction group (46.70%) while, 16.70% of the neonates of closed suction group returned to the temperature baseline reading. Statistical significant difference was found between both groups 10 minutes after suction ( $P=0.02$ ).

Table (VI) illustrates the comparison between closed and open suction neonate's groups in relation to cardiopulmonary parameters. As the table clarifies, the neonates who received closed suction showed more improvement in their oxygen saturation level immediately after suction and after 10 minutes of suction than those who received open suction. The 10% of neonates of closed suction group who had oxygen saturation 95 before suction increased to 46.70% immediately after suction compared to the 30% of the neonates of open suction group who had their percentage decreased to only 3.3% immediately after suction. Ten minutes after suction, further improvement in oxygen saturation was observed

among the neonates of closed suction group where 73.30% had oxygen saturation 95% compared to 36.70% of the neonates of open suction group who had oxygen saturation 95%. Statistical significant differences were found between both groups immediately after suction ( $P = 0.000$ ) and after 10 min ( $P= 0.014$ ) as shown in (Table XII).

Concerning the capillary refill, it was clear from the table that the 70% of the neonates of the closed suction group who had capillary refill 1-2 second before suction increased to 96.70% immediately after suction. Among the open suction group, 86.7% had a capillary refill 1-2 second but this percent declined to 60% immediately after suction. Ten minutes after suction, all neonates of closed suction group had capillary refill 1-2 second (100%) compared to 83.30% of the open suction group. The differences among both groups before suction, immediately after suction and 10 minutes after suction were statistically significant. ( $P = 0.003$ ,  $0.000$  and  $0.015$  respectively).

It is revealed from (Table VI) that, the frequency of cardiac arrhythmia improved in the neonates of closed suction group than the neonates in the open suction group. The 50% of the neonates of closed suction group who had cardiac arrhythmia before suction declined to 23.3% immediately after suction and 13.3% after 10 minutes. While the 43.3% of the neonates of open suction group who had cardiac arrhythmia before suction increased to 70% immediately after suction and 53.3% ten min after suction. The differences were statistically significant between both groups immediately and 10 minutes after suction. ( $P= 0.000$  and  $0.001$  respectively).

#### 4. Discussions

A large number of premature neonates require prolonged ventilatory support. There are a number of reasons for neonatal mechanical ventilation including hyaline membrane disease, pneumonia, respiratory failure and apnea. Mechanical ventilation will improve ventilation and perfusion of the neonates and support pulmonary gas exchange. In order to provide ventilatory support an artificial airway must be inserted. This airway can be established in one of two ways, either with an endotracheal tube or through a tracheostomy tube. Regardless of which method is used, the neonate's upper airway is bypassed, thus reducing the neonate's ability to clear secretions spontaneously. Additionally, the presence of the tube may lead to an increase in sputum production. For these reasons neonates with an artificial airway in place will require airway suctioning (Curley, 2001 & Hockenberry et al, 2005).

The biological characteristics of the present study reflected that the majority of the studied

neonates in both groups had hyaline membrane disease. This result may be related to the gestational age where the majority of neonates were preterm (Table I, Table III). This finding is supported by many researchers who reported that hyaline membrane disease usually occurs in neonates less than 35 weeks of gestation. It represents a major problem in neonatal intensive care units and is considered the primary cause of mortality (Ashwill et al, 2002, Curley, 2001& Hockenberry et al, 2005).

Suctioning is the most frequently performed nursing procedure in NICUs. The practice of endotracheal suctioning (ES) of ventilated neonates is necessary for removing secretions to prevent obstruction of endotracheal tube and lower airway. This procedure is essential but potentially hazardous because it creates a large variety of heart and lung interferences (Lindgren, 2007, Greenough, 1999, Gould, 1996, Shelly, 1999, Lasocki et al, 2006).

Closed suction system has been available for several years; however, its use in neonates is limited. Protocols for ES of the neonate are inconsistent throughout and within neonatal intensive care units. Although, a recent neonatal systematic review concludes that there is insufficient evidence to support the practice of CSS, yet, a number of studies have examined the use of CSS to maintain PEEP and minimize the decreased arterial oxygenation that accompanies OSS. Unfortunately, most of these studies have reported the effects of CSS on respiratory variables only and have not examined the effects of both systems on the cardiovascular parameters (Subirana, 2004, Maggiore et al, 2003& Morrow et al, 2006). Thus, the current study was conducted to compare the effect of closed versus open suction system on the cardiopulmonary parameters of ventilated neonates.

Craig (2002) ascertained the importance of neonatal chest assessment for checking the abnormal sounds that are considered the main criteria for obstructed airway (Craig, 2002). The findings of the current study revealed that the majority of both groups had adventitious sounds before suction which include crepitations, rhonchi and wheezes (Table IV). These adventitious sounds could be explained by the increased secretions in neonate's airway. These adventitious sounds are considered as appropriate indicators for suctioning. Another explanation for the presence of adventitious sounds may be related to the original disease that required intubation and initiation of ventilation.

Also, the result of this study reflected that there were statistical significant differences between the closed suction group and open suction group regarding the crepitation and wheezes 10 minutes after suction (Table IV). These findings could be

interpreted in the light of the fact that CSS is more adequate in removing secretions that may obstruct the airway more than the OSS. These findings are contradicted by Urden et al. (2004) who reported that CSS inadequately removed secretions, and further investigation is required to settle this issue (Urden et al, 2004).

The result of the present study revealed that, the incidence of bradycardia was not increased in closed suction group either immediately after or 10 minutes after suction (Table V). This result is similar to the finding of Wilinska et al. (2005). This finding could be justified by the fact that CSS permits spontaneous lung inflation and continuous oxygen flow during the suction procedure thus may prevent a reflexive bradycardia. On the other hand, many authors reported that bradycardia is associated with open suction system (Galvin, 1997, Lee, 2001, Corderro et al, 2002, Johnson et al, 1994&Scanlon et al, 2004).

This result was consistent with the result of the current study as the open suction technique increased the incidence of bradycardia among the neonates immediately after and 10 minutes after suction (Table V). This finding could be explained by the fact that bradycardia may arise due to vagal triggering by stimulation from the suction catheter (Zahran, 2001). On the Contrary, Deppee et al. (1994), who conducted a study about costs and physiologic consequences of closed versus open endotracheal suctioning, reported that both methods of suction increased the mean heart rate immediately after suction and 30 seconds after suction, and that OSS was associated with significantly higher mean heart rate than closed method (Deppee et al, 1994).

The present study revealed that, the closed suction group showed a significant increase in capillary oxygen saturation (SPO<sub>2</sub>) immediately after suction and further increase was observed 10 minutes later (Table VI). On the contrary, the open suction group showed a significant decrease in SPO<sub>2</sub> immediately after suction and then increased after 10 minutes. The results also revealed that the increase in oxygen saturation was higher in closed suction group than the open suction one (Table VI). These findings could be interpreted in the light of the fact that CSS could reduce the oxygen desaturation where the neonate was not disconnected from the ventilator which is one of the steps in OSS (Glass et al, 1999, Paul-Allen, 2000& Zeitoun, 2003). Furthermore, Hooser (2002), added that during the OSS, the gas drawn from the lungs was replaced by air drawn from the atmosphere through the space left around the catheter which in turn decreases the oxygen saturation during the OSS. (Hooser, 2002). Weilte and Bettstetter (1994) also reported that although oxygen saturation



increased significantly after suction in both OSS and CSS, yet it was higher in CSS(Weitle,1994).This could be explained by the increase of  $SPO_2$  as a positive effect of pre oxygenation before ES. In addition the  $SPO_2$  was less marked in the OSS because the fraction of inspired oxygen was abruptly reduced after disconnection as well as simultaneously positive pressure ventilation and PEEP were lost (Sole et al, 2002).

The result of the current study also revealed that CSS was more effective in preventing post suctioning hypoxia (decrease oxygen saturation less than 95%) rather than OSS. These results are in agreement with the results reported by Prendiville et al. (2002)(Prendiville et al,2002). Craig (2002) who did a survey about neonatal suction techniques performed by registered nurses in Marshall reported that hypoxia may be related to three causes. Firstly, the process of mechanical suction removes gases from the airways along with secretion. The second reason could be justified by the large percentage of ventilated neonates who suffer from pulmonary diseases or premature lung development and are ventilator dependant to maintain adequate oxygenation. Finally, any disruptions of ventilator cycle such as removing the neonates from the ventilator to perform open endotracheal suctioning can also lead to transient hypoxia (Craig, 2002).In addition, Salvator et al. (2003) mentioned that, the changes of oxygen saturation which are induced by suctioning may be due to the ventilation and perfusion ratio modification that could explain transient impairment in oxygen saturation (Salvator et al, 2003).

It can be concluded from the present study that, oxygenation was better in CSS group than OSS. This result is inline with Hooser (2002), who reported that the most recent Society for Critical Care Medicine (SCCM) standard for care of patients with acute respiratory failure on mechanical ventilatory support call for using a sterile suction technique and maintenance of the patient's oxygen saturation above 90%. Thus, CSS is preferred in the achievement of SCCM standards (Hooser, 2002).

It was noted from the current finding that cardiac dysrhythmia occurred after OSS with statistical significant decline in CSS group (Table VI). This result is similar to the results of Lee and Wilkins (2001) who reported that there was a significantly higher incidence of arrhythmia among the neonate of open suction group compared to those of closed suction group(Lee,2001).The occurrence of dysrhythmia may be due to the decrease of  $SPO_2$ , in addition to the vagal stimulation. Also, it is documented by research evidence, that venous and arterial oxygen saturation remain significantly higher

and subsequently there are less cardiac arrhythmias because the ventilatory circuit is not disconnected (Rmanini, 1994).

Concerning the capillary refill, the results of the present study reflected that there were statistical significant differences between the open and closed suction groups immediately after suction and 10 minutes after suction (Table VI). The closed suction group showed more improvement in capillary refill than Open suction group. This result may be related to the hypoxia that occurred during the open suction group. Furthermore, change in intrathoracic pressure during suctioning may impede venous return, resulting in reducing ventricular preload and often cardiac output leading to hypotension (Singer, 1994).

## 5. Conclusion

Based on the findings of the present study, it is concluded that the closed suction system was more effective on the oxygen saturation, capillary refill and cardiac arrhythmia as cardiopulmonary parameters and on the physiological parameters than the opened suction system. The closed suction system maintains the PEEP during the suction compared to the open suction system which changes the PEEP of neonates.

## Recommendations

Based on the previous findings and conclusion drawn from the current study, the following recommendations are suggested:

- The neonatal intensive care units should include updated policies related to closed suction system.
- The pediatric Intensive care nurse managers should be responsible for developing standard for closed suction technique in neonatal intensive care units.
- The closed suction catheter should be available in neonatal intensive care units for ventilated neonates.



**Table (I): Biodemographic Characteristics of the Neonates**

Biological Characteristics	Closed suction n=30		Open suction n=30	
	No	%	No	%
<b>1- Age</b>				
• < 7	16	53.3	21	70
• 7 -	5	16.6	3	10
• 14 -	1	3.3	2	6.6
• 21 -	8	26.6	2	6.6
• 28 -	0	0	2	6.6
<b>Total</b>	30	99.8	30	99.8
<b>Mean ± S. D</b>	9.73±8.88		7.63±10.25	
<b>2- Sex</b>				
• Male	18	60	15	50
• Female	12	40	15	50
<b>Total</b>	30	100	30	100
<b>3-Birth Weight /gm</b>				
• Very low birth weight	13	43.30	13	43.30
• Low birth weight	12	40	14	46.70
• Normal birth weight	5	16.70	3	10
<b>Total</b>	30	100	30	100
<b>Mean ± S. D</b>	1578.3±718.07		1597.8±635.21	
<b>4-Gestational age</b>				
• Preterm	23	76.70	25	83.30
• Term	7	23.30	5	16.70
<b>Total</b>	30	100	30	100
<b>Mean ± S. D</b>	32.63±4.34		32.77±3.81	

**Table (II): Characteristics of the Neonates Regarding Type of Labor, Duration of Intubation, Endotracheal Tube and Suction Catheter Size**

Characteristics	Closed suction n=30		Open suction n=30	
	No	%	No	%
<b>Type of labor</b>				
• Normal delivery	12	40	7	23.3
• Cesarean section	18	60	23	76.7
<b>Total</b>	30	100	30	100
<b>Duration of intubation</b>				
• < 1 week	13	43.30	22	73.30
• 1 week -	4	13.30	2	6.70
• 2 weeks -	3	10	4	13.30
• 3 weeks -	8	26.70	2	6.70
• 4 weeks	2	6.70	0	0
<b>Total</b>	30	100	30	100
<b>Endotracheal tube size(French)</b>				
• 2.5 Fr	5	16.6	4	13.3
• 3 Fr	15	50	15	50
• 3.5 Fr	10	33.3	11	36.3
<b>Total</b>	30	99.9	30	99.9
<b>Suction catheter size(French)</b>				
• 6 Fr	30	100	25	83.30
• 8 Fr	0	0	5	16.70
<b>Total</b>	30	100	30	100

**Table (III): Distribution of Neonates of Closed and Open Suction Groups According to their Diagnosis**

Diagnosis*	Closed group n=30		Open group n=30		Total n=60	
	No	%	No	%	No	%
-Hyaline membrane disease	24	80	29	96.7	53	88.3
-Neonatal sepsis	9	30	6	20	15	25
-pneumonia	20	66.7	21	70	41	68.3
-Pneumothorax	4	13.3	2	6.7	6	10

\*Some neonates have more than one diagnosis.

**Table (IV): Comparison of Chest Assessment between Closed and Opened Suction Groups of Neonates**

Chest Sound	Before suction n=30					Immediately after suction n=30					Ten min After suction n=30				
	Closed		Open		Z Test	Closed		Open		Z Test	Closed		Open		Z Test
	N	%	N	%		N	%	N	%		N	%	N	%	
Crackle-	30	100	27	90	0.07	12	40	19	63.3	0.06	1	3.3	21	70	0.000*
Rhonchi	6	20	6	20	1.00	5	16.7	5	16.7	1.00	5	16.7	5	16.7	1.00
Wheezes	13	43.3	10	3.3	0.42	3	10	7	23.3	0.16	2	6.7	8	26.7	0.03*

\* Statistically significant at <0.05

**Table (V): Comparison between Closed and Opened Suction Groups of Neonates Regarding Physiological Parameters**

parameters	Before n=30					Immediately after suction n=30					Ten min after suction n=30				
	Closed		Open		FET	Closed		Open		FET	Closed		Open		FET
	No	%	No	%		No	%	No	%		No	%	No	%	
Heart rate : (b/m)															
• <120	1	3.30	1	3.30	0.775	1	3.30	8	26.70	0.006*	1	3.30	18	60	0.10
• 120-140	18	60	8	26.70		23	76.7	10	33.30		25	83.30	7	23.30	
• >140	11	36.70	21	70		6	20	12	40		4	13.30	5	16.70	
respiratory rate: (c/m)															
• <30	7	23.30	4	13.30	0.683	7	23.30	4	13.30	0.683	7	23.30	5	16.70	0.61
• 30-50	16	53.30	17	56		16	53.30	17	56.70		16	53.30	15	50	
• >50	7	23.30	9	30		7	23.30	9	30		7	23.30	10	33.30	
Temperature:(°C)															
• <36.5	5	16.70	5	16.70	0.624	4	13.30	8	26.70	0.271	5	16.70	14	46.70	0.02*
• 36.5-37.5	22	73.3	19	63.30		23	76.70	17	56.70		22	73.30	12	40	
• >37.5	3	10	9	20		3	10	5	16.70		3	10	4	13.30	

FET=Fisher's Exact Test.

\*Significant at P>0.05

**Table (VI): Comparison between Closed and Opened suction groups of Neonates regarding Cardiopulmonary Parameters**

Parameters	Before suction n=30					Immediately after suction n=30					Ten min After suction n=30				
	Closed		Open		FET	Closed		Open		FET	Closed		Open		FET
	No	%	No	%		No	%	No	%		No	%	No	%	
Oxygen saturation (%)															
• 75-84	8	26.70	8	26.70	0.251	1	3.30	14	46.70	0.000*	0	0	4	13.30	*0.014
• 85-94	19	63.30	15	50		15	50	15	50		8	26.70	15	50	
• 95	3	10	9	30		14	46.70	1	3.30		22	73.30	11	36.70	
-Capillary refill															
• 1-2 sec	21	70	26	86.70	0.003*	29	96.70	18	60	0.000*	30	100	25	83.30	0.015*
• >2 sec	9	30	4	13.30		1	3.30	12	40		0	0	5	16.70	
-Cardiac arrhythmia	15	50	13	43.3	0.607	7	23.3	21	70	0.000*	4	13.3	16	53.3	0.001*

FET=Fisher's Exact Test.

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## Awareness of Sodium Lauryl Sulfate & Sodium Laureth Sulfate Health Hazards among Users

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**Abstract:** Some ingredients of personal care products have health hazards and population awareness of these health hazards helps to reduce their occurrence, late reporting & misdiagnosis. So, this study was done to assess the awareness of a sample of Egyptian users with health hazards of foam producing agents; Sodium Lauryl Sulfate and Sodium Laureth Sulfate and to test the influence of socio-demographic characters on awareness. A self-administered questionnaire was used for participants to collect data of some socio-demographic characteristics, knowledge about these substances, reading ingredients practice and attitude towards change. The results showed that the awareness of Sodium Lauryl Sulfate and Sodium Laureth Sulfate health hazards was minimal. More than 81% of the interviewed persons never heard about them or know that a harmful ingredient may be present in personal care products. The significant factors associated with hearing about this were female gender, practice reading compositions, living in a villa and having a car. The basic practice of reading the composition of what one use was deficient among 38% of participants but the attitude towards stop or change harmful products was present among the majority (94%). In conclusion, the level of awareness of Sodium Lauryl Sulfate and Sodium Laureth Sulfate health hazards was low among Egyptian users as many difficulties face the practice of reading products' ingredients but the attitude towards change is very much encouraging. Therefore, agreeing on an international code for labeling of publicly used products, increasing the public's awareness and further researches are very much needed.

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**Keywords:** Sodium Lauryl Sulfate; Sodium Laureth Sulfate Health Hazards; User

### 1. Introduction:

Although multiple research results about health hazards of Sodium Lauryl Sulfate (SLS) and *Sodium Laureth Sulfate* (SLES) are added every year, the awareness of these hazards among users are not focused on (Törmä et al., 2008 & Cebotari et al., 2010)

Sodium Lauryl Sulfate (SLS) is an anionic surfactant naturally derived from coconut and/or palm kernel oil. It usually consists of a mixture of sodium alkyl sulfates, mainly the lauryl. SLS lowers surface tension of aqueous solutions and is used as fat emulsifier, wetting agent, and detergent (Löffler and Happle, 2003). *Sodium Laureth Sulfate* (SLES) is a newer detergent that has nearly the same properties as SLS. It was developed to be less irritant, however, its effects were found to be more long-lasting in the body tissues (Drug bank, 2005).

Sodium lauryl sulfate was used as a flea and tick repellent in one registered pesticide product, a flea and tick shampoo for cats and dogs. Then Sodium lauryl sulfate becomes a widely used component of many nonpesticidal consumer products (Environmental Protection Agency, 2000). SLS & SLES are commonly used in soaps, shampoos, children shampoos, body wash, mouthwash and washing-up liquid, lotions and creams as shaving

cream, tooth paste and sun cream. Manufacture companies prefer them as they are cheap and very effective foaming agents (Marrakchi and Maibach, 2006). The same chemicals are used in dish soap, laundry detergent, stain remover, carpet cleaner, car wash, car engines degreaser and garage floor cleaner. (National Institute of Health, 2009).

SLS is a known standard skin irritant. It is used throughout the world as a research tool to irritate skin of test animals and human volunteers for testing the effectiveness of healing agents on the irritated skin (De Jongh et al., 2006). SLES dissolves the oils on skin causing a drying effect, trans-epidermal water loss and denaturation of the skin proteins leading to irritation, infection and may even skin cancers (Tanneberger et al., 2010).

Concentrations of SLS as low as 0.5% could cause irritation and concentrations of 10-30% caused skin corrosion and severe irritation. Some soaps have concentrations of up to 30%. The cutaneous reaction to SLS and SLES is influenced by the duration of application and the irritant concentration. Subclinical surfactant-induced skin surface alterations and irritation by SLS and SLES can be detected after as few as three washes (Charbonnier et al, 2001). SLES can lead to direct damage of hair follicles and skin and can cause eye irritation, scalp irritation, tangled



hair and swelling of the hands, face and arms (Takahashi et al., 2009).

Carcinogenic nitrates can form during manufacturing SLS or by its inter-reaction with other nitrogen bearing ingredients within the compound. Some products containing SLES have been found to contain very low levels of the probable human carcinogen 1,4-Dioxane which is generated during ethoxylation process. (Environmental Protection Agency, 2000).

SLS & SLES are thought to permanently keep eyes of the children from developing properly as tests showed that in young animals with skin contact even in non eye areas. This possibly occurred by proteins denaturation and structure formation prevention. Other studies have indicated that SLS& SLES enter and maintain residual levels in the heart, liver, lungs and brain from skin contact. Another worrying effect of SLES is estrogen-like action (Riviere et al., 2010).

Many of products of famous brands labeled as "natural" or "Herbal" still use these chemicals as their main active ingredient. So, population should be directed to check the ingredients of personal care products they buy themselves (Bergfeld et al., 2005).

No previous research studied the awareness of users of health hazards of these agents. So, it was important to assess the awareness of health hazards of SLS and SLES among users to reduce the occurrence of these hazards and avoid late reporting & misdiagnosis. Users included in this study were of very high educational and occupational level; mainly university teaching staff, doctors, pharmacists and engineers as those are the suitable Egyptian sample for such study.

## 2. Subjects and Methods:

### Study design and population:

The study was carried as a cross-sectional survey during the second half of 2010. As products containing sodium lauryl sulfate and sodium laureth sulfate are mainly used by the high social class groups in Egypt, so, this study included 970 high social class Egyptians aged 20 years and more. Inclusion criteria were being Egyptian with high professional occupation, higher than university education and sufficient income as indicated by residing a separate flat or higher residence with or without having a car or more. Scoring educational level, indwelling level and having a car was done and according to the median of the score, the studied high class group was classified into two grades ; grade<sub>1</sub>( less than the median) and grade<sub>2</sub> (more than the median).

The sample was from 9 different Egyptian governorates. Participants were interviewed in areas where subjects with required criteria are usually

present as high professions' syndicates, scientific conferences, private profession practices and competency development programs for university teaching staff. The sample size was calculated to be 970 subjects (based on a pilot study) using EPI-INFO statistical program version 6. Non response rate was less than 1%.

### Ethical issues:

Free informed consent was got from each participants and the questionnaire was anonymous. Data confidentiality was kept.

### Data collection and scoring:

A self-administered semi-structured specifically- designed questionnaire was used after its pilot testing& validation. It was distributed during a short standardized interview. The questionnaire included questions to collect data about some socio-demographic characteristics, knowledge about sodium lauryl sulfate and sodium laureth sulfate including if ever hear their names or know that hazardous chemicals may be present in personal care products, if know the properties for which they are used, categories of products containing them and their health hazards . For participants who chose "Yes", they were asked to write down the answers. Attitude was asked about by the readiness to change or stop using harmful products while practice was asked about by practicing reading ingredients of personal care products they use. For participants who chose "No", they were asked to choose or write down the reasons. The questionnaire was ended with a request for any comment or note.

The score of different aspects of knowledge such as the advantageous properties of SLS& SLES, categories of products containing them and their health hazards...etc, was formed by the sum of answers of related questions. A total score for awareness was formed by the sum of the different aspects of knowledge and was classified into three levels: less than 50% was considered "Low", from 50 to less than 75% was considered "Medium" while from 75 % and more was considered "Good."

### Statistical analysis:

Collected data were handled using a data base software programs (SPSS version 10 and EPI-INFO 6). Analysis included univariate, bivariate as well as multivariate analytical techniques. Independent variables were analyzed descriptively by frequency distribution and (mean±standard deviation) whenever possible. Chi square test with corresponding *P*-value was used to test the significance for qualitative variables. Binary logistic regression was carried out to identify variables most predictive of hearing about

harmful compounds in personal care products among the surveyed users.  $P < 0.05$  was used as the level of significance.

### 3. Results:

As shown in Table (1) only 1% of participants had a good level of knowledge as revealed by total score.

The age range of participants was 20 to 60 years with 75% of them less than 40 years. Males and females were nearly equally represented in the sample. They were mostly of high level of postgraduate education (more than 92% were having master degree or higher). Half of participants were university teaching staff while physicians and pharmacists represented 27%. Only 5% were residing villas while 73% had a car. The majority (64%) were representing the large sector of users with modest high social class grade (Table2).

More than 96% of the participants were from urban areas and the same percent were married and had children and all participants were having sufficient income.

The majority of participants (81.4%) have never heard about harmful ingredients in personal care products and they don't know the names of sodium lauryl sulfate (SLS) and sodium laureth sulfate (SLES). Comparing participants who have never heard about harmful ingredients in personal care products (81.4%) with participants who heard about them (18.6%) by their socio-demographic characters revealed that the gender, practice of reading ingredients, having a car, housing level as well as the

grade of the high social class were the significant factors.(Table2).

In regression analysis of significant factors that influence hearing about SLS& SLES, the grade of high social class became no longer significant while the significance of reading ingredients, having a car, gender and housing level persisted. (Table 3).

The participants' knowledge about the important aspects regarding SLS &SLES as categories of products containing them and their health hazards for adults and children were deficient among (94%) of participants. The awareness in all aspects is significantly higher among who practice reading ingredients compared to who don't read them while the attitude towards change was very high among both group without significant difference (Table 4).

Among the only 18.6 % of participants who heard about (SLS) & (SLES) or harmful ingredients in personal care products, two-thirds or more don't know their health hazards for themselves or for children (66.7%) nor the categories of products contain them (72%) (Table 5).

Table (1): Total Score of awareness level of SLS and SLES health hazards among the sample (N=970)

Total score	N	%
1) Low (less than 50%)	940	96.9
2) Medium (50 to less than 75%)	20	2.1
3) Good (75% and more)	10	1.0

Mean  $\pm$  SD =  $1.04 \pm 0.24$  Range 1- 14 out of total score= 17

Table (2): Characteristics of the interviewed sample (N=970) in relation to if they ever hear about SLS & SLES (or harmful ingredients in personal care products)

Characteristics	Hear		Never hear		Total		P
	N	%	N	%	N	%	
Age: 20-39	130	72.2	600	75.9	730	75.3	1.09
40-60	50	27.8	190	24.1	240	24.7	
Sex: Male	60	33.3	440	55.7	500	51.5	29.35
Female	120	66.7	350	44.3	470	48.5	
Edu: Post University Studies	20	11.1	60	7.6	80	8.2	2.42
Master	80	44.4	370	46.8	450	46.4	
MD & higher	80	44.4	360	45.6	440	45.3	
Occ: University staff	100	55.6	400	50.6	500	51.5	3.3
Physicians & Pharmacists	50	27.8	210	26.6	260	26.8	
Engineers & Bank managers	30	16.7	180	22.8	210 <sup>#</sup>	21.6	
High social class: Grade 1	90	50.0	530	67.1	620	63.9	18.56
Grade 2	90	50.0	260	32.9	350	36.1	
Housing: Flat	160	88.9	760	96.2	920	94.8	16.04
Villa	20	11.1	30	3.8	50	5.2	
Car: No	10	5.6	250	31.6	260	26.8	50.86
One or more	170	94.4	540	68.4	710	73.2	
Read ingredients: No	30	16.7	340	43.0	370	38.1	43.2
Yes	150	83.3	450	57.0	600	61.9	
Total	180	100	790	100	970	100.10	
		18.6		81.4		0.	

\* = significant difference

# Bank managers were 10

Table (3): Binary Logistic regression of factors affecting ever hearing about SLS&amp; SLES (or harmful ingredients in personal care products) among participants (N=970)

Independent variables	B± S.E	Wald	P
Read ingredients	1.49 ± 0.23	41.45	0.000*
Having car	2.14 ± 0.35	36.86	0.000*
Sex	0.97 ± 0.2	23.32	0.000*
Housing level	1.38 ± 0.37	14.0	0.000*
High Social class grade	0.35 ± 0.2	2.9	0.089
Constant	7.81 ± 0.7	123.8	0.000

Table (4): Knowledge and attitude towards SLS and SLES among participants who read ingredients versus who don't read them (N=970)

Reading ingredients	Read		Don't read		Total		2	P
Awareness aspect	N	%	N	%	N	%		
Know adventitious characters: Yes	100	16.7	0	0.0	100	10.3	68.8	0.000*
No	500	83.3	370	100.	870	89.7		
Know categories of products in which they are included: Yes	50	8.3	0	0.0	50	5.2	32.5	0.000*
No	550	91.7	370	100.	920	94.8		
Know their health hazards : Yes	60	10.0	0	0.0	60	6.2	39.4	0.000*
No	540	90.0	370	100.	910	93.8		
Know their hazard to children: Yes	50	8.3	10	2.7	60	6.2	12.5	0.000*
No	550	91.7	360	97.3	910	93.8		
Ready to change harmful products: Yes	560	93.3	350	94.6	910	93.8	0.63	0.43
No	40	6.7	20	5.4	60	6.2		
Total	600	100.	370	100.	970	100.		
		61.9		38.1		100.		

\* = significant difference

Table (5): Lack of Awareness of SLS and SLES knowledge among participants who heard their name (or heard about harmful ingredients in personal care products) (N=180)

Lake of Awareness aspect	N	%
Don't Know why they are used in products	80	44.4
Don't Know any of categories of products in which they are included	130	72.2
Don't Know any of their health hazards in general	120	66.7
Don't Know their special hazards to children	120	66.7

#### 4. Discussion:

Up to my knowledge, this is the first scientific research that considers the awareness of the public with health hazards of Sodium Lauryl Sulfate (SLS) & Sodium laureth sulfate (SLES) or hazardous ingredients of personal care products. Even the previous study which considered the population tested the variation in sensitivity but didn't consider the awareness (Lera et al, 2008).

Informing the public about hazards they are exposed to, as found by clinical researches is their right. When people know these hazards, they can avoid unnecessary exposure, perceive the occurrence of a problem and link it to the exposure and protect their children from such hazards. However, lack of complementation between public health and clinical research disciplines, together with pressure of

industrial and trade world hinder the needed efforts for wide dissemination of information. These are known to occur in both developed and developing world as well (Blouin, 2007).

The problem is more in developing world because of many factors. First, clinical researches are usually published in English which isn't the mother tongue for many developing countries, second, people of different social classes are busily working most hours of the day to earn enough money to live, third, excessive wasting of time occurs during getting the daily requirements. As a result, people usually don't have the "luxury" of searching what are the newly discovered health hazards.

Although health hazards of SLS& SLES are not a major concern for the "Poor" in Egypt, public health discipline can't ignore prevention of health

problems that may involve the “Rich” as discrimination is not accepted against either of them. As children are exposed to these hazards, this put high responsibility on public health specialists to protect them from additional devastating problem to what they suffers (El-Sharkawy, 2001).

This study revealed very low awareness level as those with 50% and more of the score only presented 3.1%. So, I couldn't compare who had good knowledge score with those who can't got a good score to found what influence awareness. Instead, I compared who ever heard about these substances or harmful ingredients in personal care products (18.6%) with who never heard about this issue. The low awareness level ensures the deficiency of informing the public with research results (Kartono and Maibach, 2006)

Sex, housing, having a car, grade of high social class and reading ingredients practice were the significant factors associated with hearing about these substances. In logistic regression analysis, all factors remained significant except the grade of high social class which became no longer influencing.

The significantly more females heard about SLS& SLES found in my study is logic as they use many of products containing them as shampoos and sun cream for themselves and their children more than males and mothers routinely screen what they use for kids (Bergfeld et al. , 2005 ). Another factor is the more involvement of females in the kitchen which develops the habit of reading food ingredients, then, this habit grow up to involve reading ingredients of other products . However, males are not excluded from using shampoos, toothpaste, shaving cream that may cause skin irritation but they are usually more busy and have no time to read ingredients (De Jongh et al., 2007).

The Significantly more percentage of who heard about these substances among who have cars and who live in villas may be explained by presence of these ingredients in products used for cleaning car, car engine & garage floor (Wikipedia, 2010).

Participants who practice reading ingredients were found to have significantly better knowledge of all aspect regarding SLS& SLES. The positive attitude of readiness for changing products containing harmful components is high among all participants whether they practice reading or not without significant difference. This reflects how much the participants are keen to avoid hazards and this agrees with researches about behavioral aspects behind persons' health related behavior (Gillibrand and Stevenson, 2006).

Although reading ingredients practice is good in more than 60% of included sample, the knowledge is good in only 1%. The solution of this quiz could be

got from comments of participants who denoted very important aspects regarding the low benefit they got from reading ingredients. First, they may fail in reading ingredients as they are usually written in very small font size and on most products in English only. Also, multiple names of many chemicals are written without any notice or knowledge of why each substance is used in the product or its possible hazards. This is strongly criticized with products containing dangerous chemicals that have cell-toxicity (Tanneberger et al., 2010).

Regarding participants who don't read ingredients, some of them said that they believe in the safety of publicly available products as the government surely grantees them. On the contrary, others don't trust what is written on the products and think that harmful ingredients may be included without been mentioned. This lack of trust needs real governmental effort to prove interest in the population health. Trust in the government is influenced by satisfaction with different governmental services and political democracy (Christensen and Lægheid, 2002).

Among those who have ever heard about SLS& SLES (or harmful ingredients in personal care products) the majority only know that they are foam producing agents but the important items of health hazards or category of products containing them other than shampoos are not known for their majority denoting the obvious deficiency of awareness in this health related area. We don't blame participants but blame ourselves- as public health specialists-, the government, the mass media and the scientific community to ignore increasing the public awareness of these health hazards and many other health hazards.

## 5. Conclusion

The level of awareness of Sodium Lauryl Sulfate and Sodium Laureth Sulfate health hazards was low among the included Egyptian sample. What is more worrying is the fact that the important aspects as hazards for children, health effects on adults and categories of products containing the harmful substances, were very little perceived. Also, the basic practice of reading ingredients was unsatisfactory, however positive attitude towards adoption of healthy behavior was very much encouraging. Therefore, there is a need for raising awareness and agreeing on an international code for labeling in order to improve practice of reading products' components. Also, more researches are very much needed.

## Recommendation

1- International codes for labeling and illustration of ingredients of personal care products & their

possible hazards in users' language(s), with suitable font size are very much required. Insertion of an accompanied pamphlet may be also considered.

- 2- Mass media health education to increase awareness of these health hazards among users and their children is needed with motivating people to regain trust and interest.
- 3-Scientific community must agree on a way to disseminate research results considering publicly used products to users.
- 4- Conducting researches on presence of such health hazards among workers with industrial exposure to SLS& SLES and among users of general population after rising their awareness and also, studying awareness with other harmful exposures are strongly required.

**Competing interest:** None at all.

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## Ratio of Middle Cerebral Artery / Umbilical Artery Doppler Velocimetry and Status of Newborn in Postterm Pregnancy

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**Abstract:** Objective: Doppler velocimetry studies of placental and fetal circulation can provide important information regarding fetal well-being providing an opportunity to improve fetal outcome. The present study was undertaken to evaluate the role of middle cerebral to umbilical artery blood velocity waveform's systolic/diastolic ratio (MCA/UA) as a predictor of perinatal outcome in postterm pregnant women. Patients and Methods: This prospective case control study included one hundred pregnant women who were stratified into two groups. Fifty pregnant women during the third trimester (control group = group A) and fifty pregnant women with gestational age > 41 weeks (case group = group B). The results of the MCA/UA ratio were evaluated with respect to the outcome of the infants and adverse perinatal outcome, defined as perinatal death, cesarean delivery for fetal distress, admission to the neonatal intensive care unit, days in the neonatal intensive care unit (NICU) or low Apgar score. Results: The MCA RI/UA RI ratio with cutoff value = 0.85 was found to be the most sensitive parameter in the prediction of adverse prenatal outcome. Among 22 cases admitted in NICU, 15 of them had a ratio below 0.85 (73.7%) and only 7 cases above 0.85 (26.3%). The Cereboplacental ratio screening efficiency for prediction of prenatal outcome (Birth weight <10th percentile) was 47% Sensitivity, 90% Specificity, 95% positive predictive value, 43% Negative predictive value, and for prediction of admission to NICU was 43.5% Sensitivity, 90% Specificity, 91% Positive predictive value, 45% Negative predictive value compared with the results of the present study (MCA/UA) PI ratio showed a 73.7% sensitivity and 68.3% specificity and a 52% PPV and 85% NPV in prediction of prenatal outcome (Birth weight <10th percentile) and 71% sensitivity and 72% specificity and a 79% PPV and 63% NPV in prediction of admission to NICU. Conclusion: Doppler velocimetry studies of placental and fetal circulation can provide important information regarding fetal well-being, yielding an opportunity to improve fetal outcome. Although the sample size of our study was small, our results suggested that the MCA/UA Doppler ratio of less than 1 was a good predictive tool for neonatal outcome in postterm pregnant women and could be used to identify fetuses at risk of morbidity.

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**Key Words:** Doppler – middle cerebral artery to umbilical artery ratio - postterm pregnancy.

### 1. Introduction:

Postdate pregnancy is a common obstetric problem. Its incidence has been estimated to be between 4-14% with an average of 10.5%<sup>1</sup>. A safe limit for continuation of pregnancy beyond expected date of delivery cannot be established as there is little agreement as to when exactly the fetal jeopardy begins. There is also controversy on whether risk of fetal hypoxia can be accurately predicted in these pregnancies. Rayburn and Chang<sup>2</sup> suggested that risk of postmaturity starts at 40 weeks. Postdate pregnancies have been associated with increased perinatal morbidity and mortality which increase after 42 weeks<sup>3</sup>. Increased incidence of induction of labor, instrumental delivery, cesarean section, shoulder dystocia, lower Apgar score, congenital malformations, meconium aspiration, and fetal asphyxia have been associated with these pregnancies<sup>3,4</sup>. These problems can be decreased by routine antepartum fetal surveillance prior to onset of

spontaneous labor<sup>5,6</sup>. The current methods of fetal surveillance like nonstress test (NST), amniotic fluid index (AFI), biophysical score (BPS), umbilical artery (UA) S/D ratio and middle cerebral artery (MCA) pulsatility index (PI) cannot accurately predict fetus at risk of adverse perinatal outcome<sup>3,6</sup>. Various studies<sup>7,8</sup> have investigated MCA and UA (CU) ratio in post-term pregnancies with high risk complicating factors like chronic hypertension, pregnancy induced hypertension (PIH) and diabetes, and found it to accurately predict fetal compromise. These conditions however, are known to affect the vascular bed and placental circulation, and hence the blood flows to the fetus. Very few studies have been done on the value of CU ratio in determining the perinatal outcome in low risk postdate pregnancies. Hence this study was designed to study the Doppler waveforms in UA and MCA, and CU ratio in uncomplicated postdate pregnancies, and to correlate these findings with the perinatal outcome. It also

aimed to determine the cutoff value of CU ratio for predicting adverse perinatal outcome in these pregnancies.

## 2. Patients and Methods:

This prospective case control study include 100 pregnant patients admitted at Ain Shams university maternity hospital, fifty of them have normal pregnancy and fifty of them have post term pregnancy.

### A. Patients:

**Group 1(Control Group) consisted of 50 pregnant females with the following criteria:**

1. Singleton, viable pregnancy.
2. Gestational age: during third trimester (31-41 weeks)
3. Medically free

**Group 2 (Post Term Group) consisted of 50 pregnant females with the following criteria:**

1. Singleton, viable pregnancy.
2. Gestational age: during third trimester (after 41 weeks)
3. Medically free

**The exclusion criteria included the following:**

1. Medical disorder with pregnancy as (hypertension, diabetes mellitus (DM), Antiphospholipid syndrome and RH, isoimmunization ... etc.).
2. Any maternal complication other than post term pregnancy.

**The inclusion criteria included the following:**

1. No obstetric or medical complications of pregnancy apart from post term pregnancy.
2. Single & viable pregnancy.
4. Gestational age: during third trimester (after 41 weeks)

### B. Methods:

**Both groups were subjected to:**

1. A detailed history taking.
2. Physical examination.
3. Ultrasound study: Gestational age determination & Fetal weight estimation.
4. Doppler study: Umbilical artery S/D, UA PI, UA RI, middle cerebral artery S/D, MCA PI, MCA RI

and ratio of MCA RI to UA RI were calculated.

5. Apgar score estimation of the neonate.

### Technique of ultrasound & Doppler Examination:

1. Transabdominal ultrasound was performed to all patients while woman was in a slightly tilted position with the head of the bed raised 30 degrees and with a small pillow under the right loin

2. The instrument is sonoace 8800 (Medison Digital GAIA) ultrasound machine with Doppler unit and a convex linear transducer (3-5 MHz).

3. Biometric measurement to assess gestational age and fetal growth through the determination of fetal biparietal diameter, abdominal circumference and femur length.

4. Measurement of the biparietal diameter (BPD) was obtained at the level of the thalamus and cavum septum pellucidum. The abdominal circumference was obtained from the junction of the umbilical vein and the lateral left portal vein.

5. Estimated fetal weight was detected using the head, abdominal and femur measurements (Hadlock *et al.*, 1984).

6. Intrauterine growth restriction (IUGR) is defined as estimated fetal weight less than the 10th percentile for the gestational age (Sand *et al.*, 2002)

7. Doppler study: The angle between the ultrasonographic beam and direction of blood flow was always <30 degrees. The Doppler signals were recorded with a 3.5 MHz curved array duplex transducer. The Doppler evaluations were performed by one doctor to avoid the Interobserver variation. The attending obstetricians had access to the MCA RI/UA RI ratio value, MCA/UA>1 was considered abnormal (Wog *et al.*, 2002).

Doppler indices were calculated by the dedicated software supplied within the Doppler equipment. The average value of at least four consecutive waveforms was calculated.

### Umbilical Artery Doppler:

The patients were placed in a semi-recumbent position with a left lateral tilt, and then the uterine contents are quickly scanned to select an area of amniotic cavity with several loops of umbilical cord. Ideally these cord loops should not be close to the cord insertion (Arias 1994). Using a Pulsed Wave Doppler, the characteristic sound and shape of the umbilical artery wave form were demonstrated and

identified. When the screen showed at least four consecutive waveforms of similar height, the image was frozen and the Doppler indices were estimated. A minimum of three separate readings were averaged before the final values were obtained. Because of the potential effect of fetal breathing movements on waveform variability, recording was performed during periods of fetal apnea.

### The Middle cerebral Artery:

The standard plan for measuring the biparietal diameter is visualized. This plane includes the thalamus and the cavum septum pellucidum, the color and flow mapping function was then superimposed and the middle cerebral artery can be seen pulsating at the level of the insula. The middle cerebral artery can be seen running from the internal carotid artery in a lateral direction into the Sylvian fissure (Vermillion *et al.*, 2000). When the screen showed at least four consecutive waveforms of similar height, the image was frozen and the Doppler indices were estimated. A minimum of three separate readings were averaged before the final values were obtained. Care was taken to apply minimal pressure by the transducer on the maternal abdomen, as fetal head compression can alter fetal intra-cranial pressure and hence the arterial flow velocity waveforms (Vyas *et al.*, 2006).

### Then MCA (RI) /UA (RI) ratio was calculated

#### Neonatal Evaluation:

1. The neonates were subjected to APGAR scoring at 1 & 5 minutes.

2. Adverse Neonatal outcome is considered by the following criteria:

- I. APGAR score is less than 6 at 5 minutes.
- II. Neonatal admission to neonatal intensive care unit.
- III. Neonatal death either intrauterine or early after birth.

### 3. Results

#### Statistical Analysis:

Analysis of data was done by IBM computer using SPSS (statistical program for social science 12) as follows:

- Description of quantitative variables as mean and SD and range.
- Description of qualitative variables as number and %.
- Unpaired t-test was used to compare two groups as regard a quantitative variable.
- Chi-Square test was used to compare qualitative variables between groups.
- Correlation co-efficient test was used to rank variables against each others positively or inversely.
- ROC (Receiver Operator Characteristic curve) was used to find out the overall productivity the best cut off value.
- P value > 0.05 insignificant, P<0.05 significant (\*) & P<0.01 highly significant (\*\*)
- Abbreviations: UA (umbilical artery), MCA (middle cerebral artery), SD (systolic diastolic ratio), RI (resistance index), PI (pulsatility index)

**Table (1) shows the clinical characters of the patients in the studied groups**

Variables	Cases N=50	Controls N=50	X <sup>2</sup>	P
Age				
>25yrs	27(54%)	24(48%)	0.3	>0.05
<25yrs	23(46%)	26(52%)		
Mean + SD	26.2 ± 2.1	25.4 ± 3.78		
Number of labors				
>2	8(16%)	23(46%)	10	<0.01
<2	42(84%)	27(54%)		
Number of abortions				
>2	8(16%)	14(28%)	2	>0.05
<2	42(84%)	36(72%)		
Gestational age (wks)	41+0.14	35.5+1.5	26	<0.01**
Gestational age (U/S)	38.8+1.6	35+1.1	12	<0.01**
Fetal weight (kg)	3130+624	3241+86	1.3	>0.05
Estimated fetal weight (EFW)	3214.6+516	2410+520	0.3	>0.05

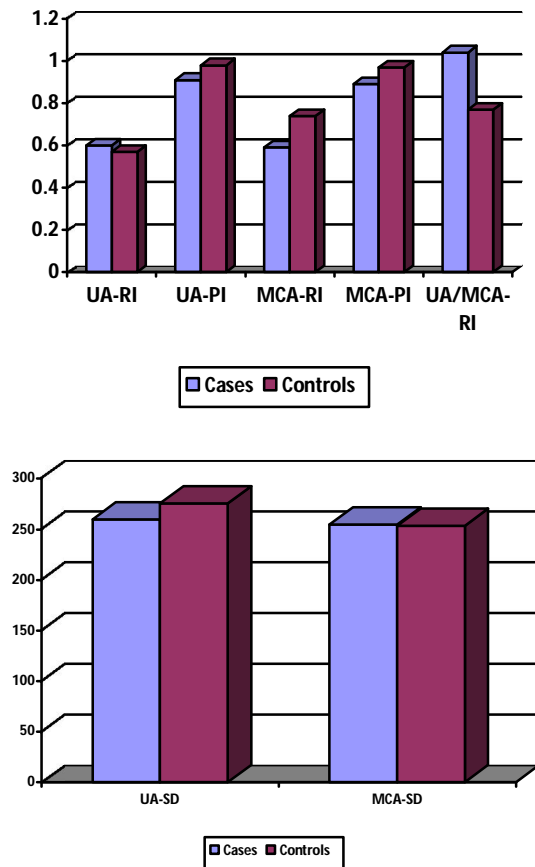


Figure (1): Comparison between cases and controls as regard Doppler indices parameters.

Table (2): Correlation between different Doppler indices parameters, age, number of deliveries and number of abortions among cases.

Doppler indices parameters	Age		No of deliveries		No of abortions	
	r	p	r	p	r	p
UA-SD	0.23	>0.05	0.20	>0.05	0.10	>0.05
UA-RI	0.03	>0.05	0.17	0.05	0.37	<0.01**
UA-PI	0.18	>0.05	-0.12	>0.05	0.19	>0.05
MCA-SD	0.20	>0.05	0.21	>0.05	-0.28	<0.05*
MCA-RI	-0.10	>0.05	0.19	>0.05	-0.29	<0.05*
MCA-PI	0.11	>0.05	0.16	>0.05	0.15	>0.05
UA/MCA-RI	-0.15	>0.05	-0.14	>0.05	0.36	<0.01**

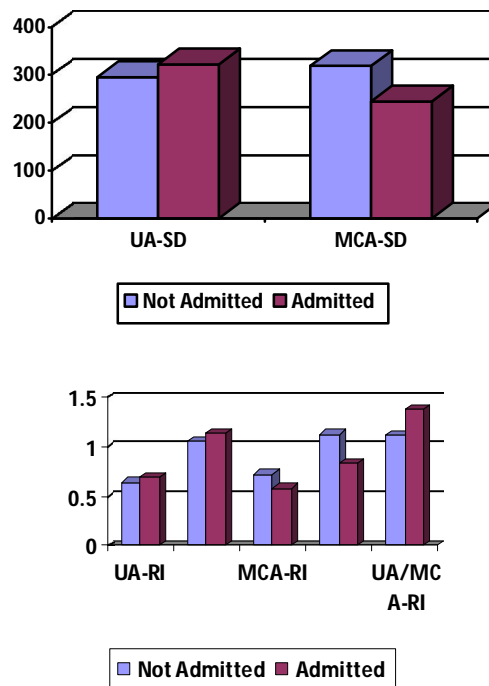
Table (3): Correlation between different Doppler indices parameters, age, number of deliveries and number of abortions among cases.

Doppler indices parameters	Age		No of deliveries		No of abortions	
	r	p	r	p	r	p
UA-SD	0.10	>0.05	-0.16	>0.05	-0.12	>0.05
UA-RI	0.21	>0.05	-0.04	>0.05	-0.17	>0.05
UA-PI	-0.01	>0.05	-0.11	>0.05	-0.20	>0.05
MCA-SD	0.20	>0.05	0.04	>0.05	0.14	>0.05
MCA-RI	-0.11	>0.05	0.13	>0.05	0.15	>0.05
MCA-PI	0.17	>0.05	0.12	>0.05	0.21	>0.05
UA/MCA-RI	-0.10	>0.05	-0.22	>0.05	-0.03	>0.05



**Table (4): Comparison of different Doppler indices parameters between neonates admitted to NICU and neonates not admitted to NICU in the studied cases.**

Doppler indices parameters	NICU		t	p
	Not admitted	Admitted		
UA-SD	2477+48	273+49	2.1	<0.05*
UA-RI	0.57+0.07	0.64+0.05	4	<0.01**
UA-PI	0.87+0.18	0.96+0.17	2.2	<0.05*
MCA-SD	266+53	212+33	4.5	<0.01**
MCA-RI	0.65+0.07	0.52+0.06	6.9	<0.01**
MCA-PI	1.02+0.1	0.73+0.1	7.2	<0.01**
UA/MCA-RI	0.86+0.25	1.2+0.17	6.3	<0.01**

**Figure (2): Relation between different Doppler indices parameters versus NICU admission among the studied cases.****Table (5): Validity of Doppler parameters in prediction of fetal outcome among post date cases.**

Doppler parameters indices	Cut off	Sensitivity	Specificity	PPV	NPV
UA-SD	257	56%	45%	14%	50%
UA-RA	0.62	50%	92%	85%	63%
UA-PI	0.93	40%	60%	48%	50%
MCA-SD	245	48%	60%	52%	57%
MCA-RI	0.67	40%	39%	40%	42%
MCA-PI	0.94	50%	40%	45%	50%
MCA/UA-RI	0.85	80%	72%	62.5%	77%
All parameters	-	85%	89%	90%	95%

#### 4. Discussion:

The use of Doppler ultrasound in high risk pregnancies appears to improve a number of obstetric care outcomes and promising in reducing prenatal

deaths (Neilson and Pretorius, 2000). Fetuses with abnormal Doppler Velocimetry had a significantly higher incidence of oligohydramnios, low birth

weight and admission to NICU. Umbilical Velocimetry, however is a test of placental function that does not always directly reflect fetal status (Arduini *et al.*, 2006). Advances in Doppler Ultrasonography have improved access to the fetal circulation. There has been a great deal of interest in the fetal intracranial vessels (Neilson and Pretorius, 2000).

The present study included 100 pregnant women admitted to Ain Shams University maternity hospital. 50 of them have normal pregnancy (31-40 week) and 50 of them have post term pregnancy (above 41 week). They were examined using transabdominal ultrasound and Doppler study for assessment of pregnancy status. The aim was to evaluate the role of transabdominal ultrasound and Doppler study during this period of gestation and detection of the best index from Doppler indices in prediction of adverse prenatal outcome. Data collected from the patients were the age, residency, occupation and special habits as well as full details of the past obstetric history for detection of any previous bad obstetric outcome. Also past surgical or medical history was taken. The current pregnancy status was fully analyzed then physical examination and ultrasound assessment were done.

In the present study, age in postterm group ranged from 23 to 27 year in comparison with control group which ranged from 24 to 26, the mean age was in cases and control  $26.2 \pm 2.1$  and  $25.4 \pm 3.78$  years respectively, which denotes that there was no significant differences between women with post term and their controls in age ( $P > 0.05$ ). we used (RI, PI, SYS/DIAS ratio) to analyze the middle cerebral and umbilical arteries wave forms, also we used MCA (RI) / UA (RI) ratio to predict a subgroup of patients at high risk for severe neonatal morbidity, and this in accordance with that of (Arduini *et al.*, 2006). The UA RI diagnostic accuracy, sensitivity and specificity were 50% and 92% respectively compared with RI (MCA) which was 40% and 39% respectively.

In a similar study done by Ozerena *et al.* 1999, it was found that RI UA diagnostic accuracy and sensitivity was 85% and 69% which was also better than that of PI (MCA) which was 58% and 42% respectively.

In a study done by Dickey *et al.*, 1997 found that the increase in the UA RI value shows the hypoxia which is caused by placental insufficiency, but would not directly demonstrate placental vascular resistance. Thus its efficacy in predicting fetal distress is found to be lower than that of the umbilical artery Doppler indices.

In the present study the UA RI/ MCA RI ratio show a higher sensitivity and diagnostic accuracy (80% and 72%) in predicting adverse

perinatal outcome when compared with UA PI (40% and 60%), UA S/D ratio (56% and 45%), MCA RI (40% and 39%), MCA PI (50% and 40%) and MCA S/D ratio (48% and 60%).

Ozerena *et al.*, 1999 who compared changes in Doppler ultrasound studies of fetal circulation in 125 normal pregnancies with 62 postterm patients both with and without intrauterine growth retardation and demonstrated the best index for predicting adverse prenatal outcome or IUGR. A cross-sectional study was performed on 125 normal pregnancies and 62 postterm patients at 31-40 weeks of gestation in the study the UA S/D ratio showed a higher sensitivity and diagnostic accuracy (88% and 94%) in predicting adverse prenatal outcome when compared with the cerebral umbilical ratio (81% and 85%), the UA PI (69% and 85%) and the MCA PI (42% and 58%). For the prediction of adverse prenatal outcome, the diagnostic inaccuracy of the MCA RI/UA RI ratio and UA Doppler indices was found to be high in patients with post term; the diagnostic accuracy was lower than the SYS/DIAS ratio of the UA.

Seyam *et al.*, 2002 examined One hundred pregnant women with growth-restricted fetuses between 28 weeks and 41 weeks by Doppler Velocimetry of the umbilical artery and evaluated fetal outcome among growth restricted fetuses and have shown that those with an abnormal S/D ratio, PI were at increased risk for early delivery, 68% of them reduced birth weight, decreased amniotic fluid at birth, and 22% of them admitted to NICU and 11% of them need positive pressure ventilation.

The sensitivity of the cerebral vessels can be used to predict IUGR of various degrees between 11% and 48% as found in the study by Gramellini *et al.* (1992). In the present study, the MCA RI/UA RI ratio with cutoff value = 0.85 was found to be the most sensitive parameter in the prediction of adverse prenatal outcome. Among 22 cases admitted in NICU, 15 of them had a ratio below 0.85 (73.7%) and only 7 cases above 0.85 (26.3%). The Cereboplacental ratio screening efficiency for prediction of prenatal outcome (Birth weight <10th percentile) was 47% Sensitivity, 90% Specificity, 95% positive predictive value, 43% Negative predictive value, and for prediction of admission to NICU was 43.5% Sensitivity, 90% Specificity, 91% Positive predictive value, 45% Negative predictive value compared with the results of the present study (MCA/UA) PI ratio showed a 73.7% sensitivity and 68.3% specificity and a 52% PPV and 85% NPV in prediction of prenatal outcome (Birth weight <10<sup>th</sup> percentile) and 71% sensitivity and 72% specificity and a 79% PPV and 63% NPV in prediction of admission to NICU.

De Vore *et al.*, 1987 expressed the values as multiples of the normal median. Receiver-operator characteristic curves (sensitivity vs false-positive rates) were plotted for the prediction of each category of prenatal outcome and the areas under the curves were determined. Stepwise logistic regression analysis were used to determine whether the Cerebroplacental ratio improved outcome prediction over umbilical artery Doppler imaging alone. Differences in the results may originate from study group differences or different criteria in defining adverse prenatal outcome.

Gramellini *et al.* 1992 have used a single cut-off value (1.08) at a gestational age of over 30 weeks and have demonstrated that the cerebral-umbilical ratio has a higher sensitivity and diagnostic accuracy (68% and 90%) when compared with the UA PI (64% and 83%) and the MCA PI (24% and 79%), respectively. Our results seem to be similar, except that in the present study the cutoff value was (1) and also higher diagnostic accuracy in the UA S/D, a parameter which Gramellini did not consider. Differences in the literature may originate from study group differences or different criteria in defining adverse prenatal outcome.

Increased placental resistance is associated with impaired fetal growth, and the severity of growth restriction is associated with the degree and duration of placental insufficiency. Thus the sensitivity of the umbilical artery Doppler indices increases in asymmetrical growth retardation. Since placental insufficiency and the cerebral adaptation mechanism are considered together, the use of the cerebral umbilical ratio shows a high diagnostic accuracy in predicting IUGR as reported in previous studies (Arias, 1994)

In fetuses with abnormal MCA/UA, Doppler ratio is strongly correlated with worse fetal prognosis. In normal pregnancies the diastolic component in the cerebral arteries is lower than in the umbilical arteries at any gestational age. Therefore, the cerebro-vascular resistance remains higher than the placental resistance and the cerebro-placental ratio is greater than 1 (Yalti *et al.*, 2004).

In the current study, sensitivity, positive predictive values of umbilical artery Doppler indices (RI, SYS/DIAS ratio) alone were 50, 92, 56 and 45 per cent respectively in comparison with (Yalti *et al.*, 2004) 30 and 50 percent respectively, who his study had small number of cases.

Yalti *et al.*, 2004 evaluated the role of middle cerebral artery and umbilical artery Doppler wave forms, and biophysical profile in prediction of fetal outcome. Although their study had a smaller number of cases their findings similar to that of the present study.

Advances in Doppler ultrasonography have improved access to the fetal circulation. There has been a great deal of interest in the fetal intracranial vessels Knowledge of Doppler flow Velocimetry of the fetal MCA may assist in prenatal diagnosis and management of complicated pregnancies (Kurjok and Kupesik, 2004). Doppler Velocimetry studies of placental and fetal circulation can provide important information regarding fetal well-being, yielding an opportunity to improve fetal outcome. (Kurjok and Kupesik, 2004).

In the current study, sensitivity and positive predictive values of MCA PI alone were 50 and 45 percent respectively. So the MCA PI alone is not reliable indicator.

Ozerena *et al.* 1999 found the MCA PI values were lower in the preeclamptic groups. Incremental changes in cerebral blood flow in cases of hypoxia reflect the degree of the hypoxic stimulus and represent a very fine control mechanism for oxygen delivery to the brain. Compared with the current study in which the MCA PI values were higher in the preeclamptic groups it may be due to smaller number of control group (30) in comparison with (125) in the other study.

The umbilical artery Doppler indices are related to placental vascular resistance, the increase in the UA RI value shows the hypoxia which is caused by placental insufficiency, but would not directly demonstrate placental vascular resistance. Thus its efficacy in predicting fetal distress is found to be lower than that of the umbilical artery Doppler indices. There is no significant relationship between fetal brain sparing and the prenatal outcome in pregnancies with increased resistance to blood in the fetoplacental circulation (Arias, 1994).

In the present study the umbilical - cerebral ratio shows a higher sensitivity (80%) in predicting adverse prenatal outcome when compared with the UA S/D ratio (56%) the UA PI (40%) and the MCA PI (50%). As regard the sensitivity of all parameters together shows higher percent (85%) in prediction adverse prenatal outcome when compared with the cerebral – umbilical ratio (80%) the UA RI (50%) and MCA RI (40%). A similar correlation between the umbilical artery and middle cerebral artery Doppler indices and predictions of adverse prenatal outcome was found in previous study (Elebrashy and Edris 2006).

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## Decentralization of agricultural extension: New way to improve rural development in Third World

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**Abstract:** The evolution of public agricultural extension arrived at a worldwide turning point in the 1980s, one that represented the end of a major phase in the growth of publicly funded extension in both the developed and developing world. Agricultural extension increasingly has become defined as one or other of (apparently) differentiated activities of technology transfer or rural development. Agricultural extension is a non-formal type of education that provides advisory services by the use of educational approach in acquiring knowledge and skills to deal with the growing needs of global world. Diverse agricultural extension funding and delivery arrangements have been undertaken since the mid-1980s by governments worldwide in the name of "privatization." When agricultural extension is discussed, privatization is used in the broadest sense – of introducing or increasing private sector participation, which does not necessarily imply a transfer of designated state-owned assets to the private sector. In fact, various cost-recovery, commercialization, and other so-called privatization alternatives have been adopted to improve agricultural extension.

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**Keywords:** Decentralization, Agricultural extension

### Introduction:

Un-fortunately in developing as well as low income countries agricultural extension has failed in diffusing new technology to its ultimate users (Government of Malawi, 2000) and further deterioration witnessed with the passage of time (Eicher, 2001). The failure of agricultural extension services for last decades is under constant pressure to be responsive to ever-growing challenges of food production.

Over the past two decades many countries have undertaken to decentralize government functions and transfer authority and responsibilities from central to intermediate and local governments, and often to communities and the private sector. Decentralization is potentially important to agricultural knowledge and information systems, but decentralization is not an end in itself, and successful decentralization strategies must address three challenges—establishing a national framework for decentralization, developing subsector approaches, and enhancing capacities of various participants for coproduction of decentralized goods and services. Agricultural extension services are under increasing pressure to become more effective, more responsive to clients, and less costly to government. Decentralization is an increasingly common aspect of extension reforms. Field extension advisory services are well suited to decentralized approaches, but a comprehensive extension system requires a range of

extension support services and programs, some of which (strategy formulation, training, monitoring and evaluation, specialized technical support) are often best carried out at the central level.

The prime challenges in the traditional public extension systems enlisted as outdated, top-down, paternalistic, inflexible, subject to bureaucratic inefficiencies that results less ability to cope with the dynamic demands of modern day agriculture (World Bank, 2002; Obaa et al., 2005). In some countries the change is occurring with its natural pace but in many developing countries these have been accelerated by structural adjustment reforms (Chapman & Tripp, 2003).

Still the performance of agriculture sector at the farm level remains significantly below the potential and limited due to the weak institutional formwork in disseminating agricultural technology to the farmers (Farooq, 2005). Research scientists evolving new methods and technologies to meet the challenges of new era and the farming community also has a potential and courage to adopt but the third component i.e. agricultural extension, which serves as a technology transfer vehicle and play a significant role in increasing the productivity, farm incomes and ensure food security has been very much weak since independence (Luqman et al., 2004; Farooq, 2005). The extension services in the country have not been able to achieve their goals effectively, because of a number of bottlenecks. These include weak research-



extension linkages, lack of adequate resources for on-farm demonstrations, poor mobility, inadequate research and training in extension methodology and lack of an effective system of continuing education for extension personnel at various levels (Sandhu, 1993). Among major field crops wheat, rice, cotton and sugarcane accounts for 90.4% of the value added in major crops and 37.1% of the value added in overall agriculture (Government of Pakistan, 2005). The low production of these crops depends upon a number of factors including ineffective and isolated agricultural extension system.

The Government of Pakistan is well aware of this fact therefore from the Day of Independence different extension and rural development programs at national level launch by her e.g. Village Agricultural and Industrial Development Programme (Village-AID), Basic Democracies System (BDS), Integrated Rural Development Programme (IRDP) and Training and Visit System (T & V). Unfortunately all these programmes were abolished one after the other because of their conventional, top down nature and inherited less effective technology transfer model (Williamson, 2002; World Bank, 2003). The last efficient extension programme was (T & V) that became ineffective due to its rigidity, top down orientation, non-responsiveness to farmers' needs, much expensive, least effective in feedback communication with farmers and unable to meet the challenges of changing circumstances. To overcome the weaknesses and shortcomings in (T & V) system Government introduced Decentralization of Agricultural Extension reforms with the name Devolution of Power Plan to up-lift the local people's economic status through pooling all the national sources and resources at grass root level. Devolution is the complete, permanent (SPDC, 2000) and advanced form of decentralization and also helps in strengthening the functions of and empowering with more authority to the elected representatives (FAO, 2001). With the promulgation of this new system, institutional reforms have been introduced almost in all the line departments including Agricultural Extension (Luqman et al., 2004). The new system of agricultural extension, works under the supervision of district Government in which each district is managing its agricultural extension activities, where the functions of all sister organizations such as Water Management, Fisheries, Livestock, Soil conservation, Forestry, etc; are put under single manager called as Executive District Officer of Agriculture (EDO) (World Bank, 2003). The administrative changes in the setup of agricultural extension department affect the working efficiency of Extension Field Staff (EFS) in their area of jurisdiction having both positive and negative impacts (Luqman et al., 2005), while on the

other hand Farooq (2005) conducted a research study in two districts of North West Frontier Province (NWFP) and observed the difficulties faced by the extension staff in post devolution framework. The major hurdles in creating difficulties for EFS in the research area were multifarious duties, double chain command and lack of administrative staff and burden of increased paper work.

Decentralization as transfer of authority and responsibility for government functions from central government to intermediate and local governments, and often to communities and the private sector has become widespread over the 1980s and 1990s. Countries with diverse systems and traditions of government have pursued decentralization initiatives for many reasons, including especially the failure of government to meet expectations under centralized approaches to economic management and service approaches to organizing public administration. Though not yet widely applied to agricultural research and extension, decentralization strategies are potentially important to these agricultural knowledge and information systems. Decentralization is frequently viewed from one of two different perspectives (Johnson, 2000).

1. The democratic view emphasizes the aspect of empowering local people to control and direct their own public programs; and

2. The administrative view emphasizes the efficiency gains resulting from improved administration and effectiveness of public programs due to local control. Decentralization is generally expected to: encourage local financing and ownership of programs, result in more efficient and equitable allocation of government resources, provide incentives for production and service delivery, ensure lower-cost service delivery, build local capacity, and respond more effectively to local needs. (Khan, 2002).

For rural programs, decentralization offers hope for correcting the urban bias that results from the geographic dispersion of rural people, the difficulties for them to organize to promote their interests, and the discrimination against agriculture inherent in many country policy frameworks. Decentralization of agricultural extension and research seeks to increase user participation in technology programs and make programs more accountable to users. (Eicher, 2001).

Enthusiasm for decentralization needs to be tempered with some caution. In small countries, decentralization may be unnecessary and in very large countries decentralization to the state or provincial level may still leave programs distant from user influence. Definitive evidence of the impact of decentralization is limited and not everyone benefits

from any reform. Furthermore, decentralization does little to improve intraregional disparities, may bring oppressive elites into power, and can lead to greater inequalities in allocation of government resources.

Thus, decentralization has the potential to increase access to and cost of services, but specific targeting mechanisms and strong central oversight are needed to avoid inequities in service access and quality. (Farooq, 2005).

### **Principles in Decentralization Reform:**

Decentralization takes many forms with varied mixes of fiscal, administrative, and political decentralization. Privatization, deconcentration, and delegation initiatives can complement and reinforce an overall decentralization policy, but these do not constitute, and can in some cases work against, effective decentralization (FAO, 2001).

Four requirements for successful decentralization are:

- Providing local people with substantial real influence over the local political system and local developmental activities;
- Ensuring availability of financial resources adequate for decentralized institutions to accomplish their tasks;
- Ensuring adequate administrative capacity in local units to carry out their tasks; and
- Establishing reliable mechanisms for accountability of politicians and bureaucrats to local people.

Deconcentration is nearly always the first—and necessary—step in any process of decentralization. This puts staff from central administrations in closer contact with local people, problems, and conditions and provides a channel for local interaction with government. Unfortunately, decentralization reforms frequently stop at this point with central authorities retaining control over deconcentrated administrative structures (World Bank, 2003).

Administrative decentralization, represents a more fundamental reform that replaces existing centralized structures with a new administrative structure of local government. Transfer of power to decentralized offices increases local participation in decisionmaking and allows programs to be tailored to local needs.

Political decentralization, makes decentralized bureaucracies accountable to locally elected officials and officials accountable to the people. Elections, referenda, and local participatory decisionmaking arrangements give people direct control over government programs, but short of these formal political processes, a variety of mechanisms (reflecting “participation” more than

“decentralization”) can give people influence over government programs. These include: incorporating local representatives into governance and advisory boards, client surveys, polls, and program “report cards,” and rapid rural appraisal techniques (Luqman et al., 2005).

Fiscal decentralization, is often seen as a way to reduce central government budgets by off-loading tasks a central government can no longer finance. In practice, however, decentralization is likely to result in higher costs for central budgets. Fiscal decentralization may transfer authority for expending funds, raising taxes, or borrowing, but intergovernmental fiscal transfers (IGFTs or “grants”) are usually the key means of financing decentralized programs.

Concern over local administrative capacity frequently leads central governments to impose controls that are costly to administer and that restrict local flexibility in managing funds. Experience would indicate that local governments are generally capable of assuming substantial responsibility, and decentralized programs can provide different financing packages to communities with different levels of capacity (Williamson, 2002).

Many programs are best implemented through “coproduction” or partnerships between various actors—central government, local government, private sector, civil society, and the individual—each providing the good or service for which it has a comparative advantage. Coproduction requires clarity in division of labor and clear “contracts” between different partners. (Sandhu, 1993).

Privatization, delegation, and devolution strategies complement decentralization and, like decentralization, broaden the institutional base for administration and execution of technology programs; reduce the burden on central governments for provision of services (responsibilities in which they have been less than fully successful); and increase stakeholder participation and influence over programs. Advantages of these complementary strategies are that:

- Full privatization relieves government of responsibility for production of private goods and services with few externalities. Extension services for commercial crops grown by wealthier farmers, information on postharvest handling and processing technologies, and marketing of machinery or production inputs often fall in this category.
- Private provision of publicly financed services takes advantage of private providers’ greater efficiency and flexibility in executing programs. Government contracting of NGOs or private extension providers is a common example.

- Delegation and devolution maintains some government authority and financing, but gives implementing institutions operational flexibility and ability to specialize. Governments may delegate extension responsibilities to research institutes or devolve responsibility for commodity extension to a commodity group (Farooq, 2005).

### **Recognizing Multiple Extension Functions:**

National agricultural extension systems (NAESs) must incorporate a range of extension activities that vary in suitability to decentralization. Field advisory services, as the traditional extension methodology, are compatible with decentralized program strategies and in some cases are suited to private service provision or complete privatization. Other services to support field extension agents and complement field advisory services are often better suited to centralized production. (Khan, 2002).

Functions best centralized are those that:

Support national strategies and financing mechanisms; involve economies of scale and scope; serve a number of administrative regions; or require greater technical input and networking than can be managed at the local level. Services needed in a comprehensive extension system include:

- Extension policy, strategy formulation, and planning (centralized);
- Training programs for extension agents (centralized or decentralized);
- Technical specialist support to extension agents (centralized);
- Production of extension publications, audiovisual materials, guidebooks, and other materials (generally centralized);
- Monitoring and evaluation to support program quality enhancement (needed at all management levels);
- Training programs for farmers (generally decentralized);
- Market information services (centralized);
- Encouragement for (and possibly some controls on) private sector extension (privatization with mixed centralized/decentralized controls);
- Mass media campaigns, including radio, television, agricultural magazines, newspapers, and letters (generally centralized, but may be decentralized or privatized); and
- Internet and/or telephone dissemination of information and fielding questions from farmers, agribusiness, or extension agents (centralized). (Farooq, 2005).

### **Decentralized Governance -Introducing Accountability:**

Decentralizing extension by involving farmers and local government in governance of programs can improve program accountability, increase user ownership of programs, ensure relevance to local needs, improve planning and information flows, and strengthen user capabilities. Transferring program responsibilities to locally elected officials directly decentralizes program governance and accountability to local people. Perhaps equally important are alternate mechanisms that increase user participation and influence over program content and operations. Reforms that enhance farmer influence over program governance include: incorporating farmers into governance and oversight committees; adopting participatory extension approaches; involving farmers in identifying priorities, planning, and monitoring; working through farmer groups; and using participatory evaluation and feedback mechanisms for program evaluation. Decentralizing governance holds particular promise for making extension programs (and agents) accountable to users. Farmers know whether they are receiving valuable services and should have the power to demand good performance by their service providers. When farmers have authority to influence decisions on program funding, hiring and dismissing staff, and staff incentives, they are truly empowered to improve services. At a minimum, all extension programs should seek farmer feedback on the relevance, quality, and usefulness of extension services. (Chapman & Tripp, 2003).

A concern in decentralized extension systems is the degree to which governance mechanisms are representative of all farmers in an area. Women, small farmers, and ethnic or cultural minorities are often underrepresented in governance groups, but may be more in need of public services than those actually representing local interests. Disadvantages of farmer governance are the high up-front costs of participatory approaches, difficulties in ensuring true representation of participating groups, risk of aggravating conflicts or unduly raising expectations, and the possibility of program capture by elites (Farooq, 2005).

As the traditional view of extension as a function of government agencies gives way in the face of multiple service providers, an expanding agenda, and a better understanding of farmer information and innovation systems, decentralized governance of extension services should become both easier and more important.

### **Fiscal Decentralization of Extension Services:**

Government inability to sustain financial support for large extension systems has been a motivation for the many reforms that attempt to

reduce public sector funding, introduce private financing, or eliminate government programs that compete with the private sector. Typically, these strategies tend to decentralize extension financing. Although an objective of many decentralization reforms has been to reduce government expenditures, local governments generally have limited resources and limited ability to raise funds. Central governments therefore must usually continue financing for extension services through intergovernmental financial transfers (IGFTs), and must also finance the considerable costs of reform and local capacity development. This increases total financing requirements for extension, at least over the short term. Over the longer term, decentralizing extension services might reduce government financing requirements by: (1) increasing efficiencies through better oversight and greater flexibility in funding decisions and (2) increasing cofinancing by being more responsive, and demonstrating greater benefits, to users. Cofinancing grants (IGFTs) to local governments or farmer groups are an important element of fiscal decentralization, but they present two significant problems: (Chapman & Tripp, 2003).

- Many local organizations lack capacity to plan, manage, and evaluate extension programs and lack the contacts and financial management capacity to procure needed services; and

- Resource-rich farmers are better able to cofinance services and capture program benefits, even if program objectives are to assist weaker elements of rural society. Still, many new initiatives are using subgrants of various types for local subprojects, and future program design can draw on this experience. Decentralization programs must address these two problems. Training and orientation, program promotion, and support services are critical to enable target clients and local organizations to take over extension responsibilities under new decentralized systems. Later, as programs are implemented, a strong monitoring and evaluation system is needed to provide management with information necessary to understand who is benefiting from the program and what real impact it is having (Farooq, 2005).

### Conclusion:

Decentralize extension services where possible, with emphasis on giving users control over program planning, implementation, and evaluation.

- Provide for adequate centralized support systems for decentralized extension services, especially support for training, subject matter specialists, and production of extension materials.

- Adapt strategies to local institutional environments to accommodate country legal

frameworks, political traditions, administrative structures, and social and agroecological conditions. Extension strategies can emphasize decentralization when there is already a strong political decentralization in the country, but should proceed cautiously when decentralization is not yet well established.

- Determine on a case-by-case basis whether decentralized services should be managed by local governments, community/producer organizations, or local governments in conjunction with producer/community organizations.

- Provide clear division of responsibilities between the different levels of government and other program participants.

- Develop procedures for policy formulation and priority setting in mixed systems to reconcile central government financing and policy objectives (poverty alleviation, food security, and environmental conservation) with local peoples' priorities that emerge from the decentralized program governance.

- Provide for needed fiscal transfers from central government to decentralized implementing agencies to finance decentralized extension services, recognizing that over the short term decentralization rarely reduces requirements for central government financing.

- Structure fiscal transfers to give users maximum influence over programs and to promote institutional pluralism in service provision. This empowers users and develops capacities in a range of public and private providers, such that the most competent institutions are able to provide the services.

- Provide for extensive planning, promotion of the rationale and principles behind reforms, and training in new operational procedures before launching decentralization reforms.

- Provide for needed investments in development of local capacity (local governments, executing agencies, community or producer groups), as such implementation capacity is critical to success of decentralization reforms.

- Establish effective systems to monitor and evaluate decentralized programs, and ensure that the data are available at all appropriate levels. Central monitoring should be sensitive to equity issues and the possibility of local elites capture of programs, thus excluding services to the poor or women.

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## Comparative Studies on the Renal Structural Aspects of the Mammalian Species Inhabiting Different Habitats

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**Abstract:** The current investigation was carried out to reveal the structural aspects of the kidney of the herbivorous guinea pigs, *Cavia porcellus*, inhabiting mesic environment, the insectivorous hedgehogs, *Paraechinus aethiopicus*, inhabiting arid environment and the omnivorous spiny mice, *Acomys russatus*, inhabiting arid environment in an attempt to elucidate whether variations in the nature of habitat and/or diet may associated with special structural renal adaptations. The kidneys of the selected species were studied morphologically, histologically and ultrastructurally. The results were markedly varied, with the spiny mice having the lightest body weight, the heaviest relative kidney weight, the well-developed complex renal pelvis, the fewest nephron numbers, the least total glomerular volume (TGV), numerous giant vascular bundles, the fewest and the narrowest filtration slits, the thickest basal lamina of both glomerular capillaries and epithelial lining of proximal and distal tubules, well developed elaborated basal infoldings and the greatest number of elongated mitochondria compared to those of the guinea pigs and the hedgehogs respectively. In contrast, the hedgehogs showed some peculiar structural features, including the huge nephron number and the greatest total glomerular volume.

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**Key words:** Rodents, Insectivorous, Kidney, Habitat, Histology

### 1. Introduction:

Adaptations of different mammalian species to life in various habitats may include different combinations of cellular, physiological, behavioral, and ecological characteristics (Gallardo *et al.*, 2005; El-Gohary *et al.*, 2008 and El-Gohary, 2009). The different mammalian species from arid and semiarid habitats are faced with the problem of water conservation in conditions where the spatial and temporal availability of free water is limited or scarce. Classically, at the individual level of biological organization, desert dwelling rodents display many physiological features that favor body water-sparing mechanisms include a high level of constitutive colonic water absorption, related to AQP-1 expression in apical and basolateral membranes of distal colonic epithelial cells (Gallardo *et al.*, 2002); reduced water evaporation through nasal passages (Corte's *et al.*, 2000); and high urine concentration (Jackson *et al.*, 2003 and El-Gohary, 2009).

The physiological adaptation of small rodents to arid conditions is achieved mainly through concentrating ability of their kidneys (El-Gohary, 2009). Conservation of water by the kidney is of crucial importance for the kangaroo rat, which does not drink and can obtain water only from catabolism,

while, other desert rodents obtain water from their diet (Bozinovic *et al.*, 2003).

Several renal adaptations that may be critical in the improvement of water conservation are described (Cooper & Withers, 2010). These adaptations include variations in the relative medullary thickness (Tirado *et al.*, 2008; Coleman & Downs, 2009 and Cooper & Withers, 2010), the length of the renal papilla (El-Gohary, 2009), number of nephrons (El-Gohary *et al.*, 2008 and El-Gohary, 2009), percentage of long-looped nephrons (Altschuler *et al.*, 1979), nephron heterogeneity (Altschuler *et al.*, 1979), development of pelvic fornices (El-Gohary *et al.*, 2008 and El-Gohary, 2009), confluence of collecting ducts, vascular bundles in the inner stripe of the outer medulla (Pannabecker *et al.*, 2008 and Yuan & Pannabecker, 2010), thin descending limb epithelium, and relative development of the three medullary zones (Pannabecker *et al.*, 2008 and Yuan & Pannabecker, 2010).

The present study was designed to elucidate whether variations in the nature of habitat and/or diet of the selected mammalian species may associated with special adaptive renal structures.

### 2. Materials and Methods

#### 1- Experimental Animals

The experimental animals of the present work included three different mammalian species of different orders which inhabiting vastly different habitats and feed on different diet. The investigated animals included guinea pigs (*Cavia porcellus*), Ethiopian hedgehogs (*Paraechinus aethiopicus*) and Golden spiny mouse (*Acomys russatus*). Guinea pigs inhabiting mesic areas and are exclusively herbivore. Hedgehogs, on the other side, are insectivorous desert inhabiting animals. They feed exclusively on insects. Golden spiny mice live in arid and semi-arid environments like deserts (South Sinai especially Saint Catherine mountain). They are omnivorous animals, where the high-salinity vegetation and invertebrates are often the only available source of nutrients and water (Kronfeld-Schor & Dayan, 1999). Ethiopian hedgehogs and Golden spiny mice were collected from their natural habitat. Guinea pigs, on the other hand were purchased from the local market.

All the studied animals were adult and healthy. Nine adult males of each studied species were weighed, sacrificed with sharp razor blade. The sacrificed animals were promptly dissected to remove out the kidneys for subsequent measurements. For the purpose of this study, the anatomy of both kidneys was assumed to be identical. Therefore, the right kidneys of the studied species were processed routinely for light microscopy and transmission electron microscopy, while, the left kidneys were used for nephron enumeration.

## 2- Morphometric Studies

The right and left kidneys were weighed separately and the papillary length of the kidneys were measured using a binocular dissecting microscope fitted with a calibrated ocular micrometer. The thickness of the cortical and medullary regions was taken from a median cross section parallel to the flattened surface of the kidney. The relative medullary thickness (RMT) was calculated following the method of El-Beltagy (2002).

## 3-Nephron Enumeration

In the present work the number of nephrons were enumerated following the method described by Maluf (1991).

## 4- Estimation of Glomerular Size

Histological renal sections of the studied species were used to evaluate glomerular size. Ten glomeruli from each nephron populations [superficial (SF), mid-cortical (MC) and juxta-medullary (JM)] were measured under light microscope fitted with ocular micrometer eye piece at magnification power of 100 X. (Solomon, 1974).

The JM/S ratio for glomerular size was considered as an index of inter-nephron heterogeneity of each species.

## 5- Histological Studies

The right kidneys of the studied species were cut along the mid dorsal plane and immediately fixed in 10% neutral formaline. The tissue was washed in tap water. Then dehydrated in ascending grades of ethyl alcohols, cleaned in xylene and finally embedded in paraffin wax at 60°C. The paraffin sections at 5-6µm in thick were prepared and stained with Haematoxylin and Eosin according to Carleton (1980).

## 6- Ultrastructural Studies

Kidneys were removed immediately and small pieces (1mm<sup>3</sup>) of the cortical tissue of the right kidneys of the studied species were excised and immersed in 2.5% glutaraldehyde in 0.1 M sodium cacodylate buffer at pH 7.2, then the tissue samples were post-fixed in 1% buffered osmium tetroxide, after which the samples were dehydrated in ascending series of ethyl alcohol, cleared in propylene oxide and embedded in epon (Casotti *et al.*, 1998). The present ultrastructure studies were done in the electron microscope unit of Faculty of Science, University of Ain Shams, Cairo.

## 7- Statistical Analysis

The present data were analyzed by a one-way ANOVA (Lindman, 1974), whereas, *P* values <0.05 were accepted for minimal statistical significance. Results were reported as mean ± SE.

## 3. Results

### 1- Body and Kidney Weights

As shown in Table (1), the mean body weight of the guinea pigs is significantly (*P*<0.001) heavier than the body weights of both the hedgehogs and the spiny mice respectively. Also, the mean body weight of the hedgehogs is significantly (*P*<0.001) heavier comparing to that of the spiny mice.

As shown in Table (1), the guinea pigs have significantly (*P*<0.01) (*P*<0.001) heavier right and left kidneys than those of the hedgehogs respectively, followed by the spiny mice which have the lightest absolute kidney weights. In contrast to the absolute kidney weights, the relative kidney weights to body weights show an opposite pattern.

### 2- The Corticomedullary Thickness and Renal Papilla

The cortical thickness of the guinea pig right and left kidneys are significantly (*P*<0.05) and

( $P < 0.001$ ) thicker comparing to those of the hedgehogs and spiny mice respectively.

In addition, the absolute medullary thickness of the right and left kidneys of the guinea pigs are obviously thinner comparing to those of the right and left kidneys of the hedgehogs. However, the medullary thickness of the hedgehogs is markedly thicker comparing to those of the right and left kidneys of the spiny mice (see Table 1).

The relative medullary thickness of the investigated species followed an opposite pattern when compared to the absolute medullary thickness as cited in Table (1).

### 3- Number of Nephrons

As shown in Table (2), the guinea pig has approximately half the number of nephrons compared to the hedgehogs and twice that of the spiny mice. In addition, the number of nephrons per gram kidney weights of the investigated species followed the same pattern of the absolute number of nephrons. Moreover, the relative number per gram body weight is significantly ( $P < 0.001$ ) lower for the spiny mice compared to those for the guinea pigs and the hedgehogs respectively.

### 4- Glomerular Size and the Total Glomerular Volumes

As shown in Table (2), the juxta-medullary nephrons have the biggest size followed by the mid-cortical nephrons and then the superficial ones which have the smallest size for all the studied species. Concerning the size of the glomeruli of the guinea pigs, they are larger (except the juxtamedullary ones of the hedgehogs only) than the corresponding superficial, midcortical and juxtamedullary nephrons of the hedgehogs and the spiny mice respectively. In addition, the size of the glomeruli of the hedgehogs is distinctly larger than the respective data of the spiny mice for all the different types of nephron populations. Regarding the values of the JM/S ratio for glomerular size of the guinea pigs is lower than those of the hedgehogs and spiny mice respectively. However, the differences are insignificant.

The values of the total volume of the glomeruli are significantly ( $P < 0.01$ ) lower than the corresponding values in the hedgehogs and significantly higher ( $P < 0.001$ ) than that of the spiny mice which have the lowest values among the studied species.

### 5- Renal Gross Anatomy

As shown in Figure (1); the kidney of the guinea pigs seems to be the largest one when compared to the kidneys of the hedgehogs and the spiny mice which have the smallest one among the

studied species. The guinea pigs have extremely short blunt renal papilla while that of the hedgehogs is moderately long and broad. The spiny mice, on the other side, have well-developed long sharp pointed renal papilla extending into the ureter.

### 6- Histological Studies

As shown in Figure (2); both the guinea pig and the hedgehog kidneys show relatively high density of large renal corpuscles evenly distributed throughout the cortex. On the other side, the spiny mice kidney shows distinctly less density of relatively small renal corpuscles. Each renal corpuscles consists of a Bowman's capsule and a glomerulus (Fig.3). The degree of the granulation of the macula densa of the different studied species is varied, with the spiny mice having the highest degree followed by the hedgehog then the guinea pigs which show the lowest degree of granulation (Fig.4).

The most outstanding components of the inner stripe of the outer medulla are the presence of the vascular bundles, each of which are formed of arterial and venous vasa recta and thin descending limbs of loop of Henle. The type of the medullae of the studied species are varied, with the guinea pigs showing simple type and the hedgehogs show moderately complex type, while the spiny mice have the most complex type of medulla among different investigated species. In addition, the vascular bundles are either of the simple type as in the guinea pigs or the giant type as in both the hedgehogs and the spiny mice. However, the density of the vascular bundles of the spiny mice is obviously greater than those of the hedgehogs (Fig.5).

The inner medulla and papilla contain only collecting ducts, thin limbs and capillary structures. The guinea pigs have extremely short blunt renal papilla. While the hedgehogs and the spiny mice have moderately long and well-developed long sharp pointed renal papillae respectively (Fig.6).

The renal pelvis appeared as a dilated cavity of the proximal end of the ureter, lodged in the sinus and facing the renal papilla. It is formed of either a simple pelvis as in the guinea pigs or a relatively complex as in the hedgehogs or a complex type with well-developed secondary fornices (pelvic recesses) and highly developed evaginations that extended between cortical and medullary tissues as in the spiny mice (Fig.6). Each fornix is formed of two folds or leaf-like projections which are lined with simple squamous to simple cuboidal epithelium with minimum amount of connective tissue.

### 7- Ultrastructural Studies

The capillary loops of the guinea pigs are narrower with thinner basal lamina than those of the

hedgehogs. While, the lumen of the capillary loops of the spiny mice are obviously wider with markedly thick basal lamina comparing to the respective structures of both the guinea pigs and the hedgehogs (Fig.7). The number, the size of the filtration slits as well as the thickness of the glomerular basal lamina are markedly varied among the studied species, with the guinea pigs have more and wider filtration slits and thinner basal lamina comparing to those of the hedgehogs and the spiny mice which show the fewest and narrowest filtration slits and the thickest basal lamina. The thickness of the filtration barrier of the guinea pigs is obviously thin when compared to that of the hedgehogs. On the other side, the spiny mice have the thickest filtration barrier.

As shown in Figure (8); the length and the abundance of the microvilli of the apical border of the epithelial lining of the proximal tubule are obviously varied, with the guinea pigs having relatively short and less abundance microvilli comparing to those of the hedgehogs and the spiny

mice whereas the latter have the longest and the most abundance microvilli among the investigated species.

The guinea pigs have relatively numerous numbers of rounded mitochondria in comparison with those of the hedgehogs. However, the spiny mice show huge numbers of elongated mitochondria with distinct densely packed cristae which occupy more area of the renal tubular epithelium. The basal lamina of the guinea pigs is distinctly thin compared to those of the hedgehogs which have moderately thick basal lamina and spiny mice which have the thickest basal lamina among the studied species.

As shown in Figure (9); the abundance of the mitochondria and the degree of the development of the basal infoldings as well as the thickness of the basal lamina of the distal tubule are varied; with the spiny mice having numerous mitochondria and thicker basal lamina and well-developed basal infoldings compared with either the guinea pigs or the hedgehogs.

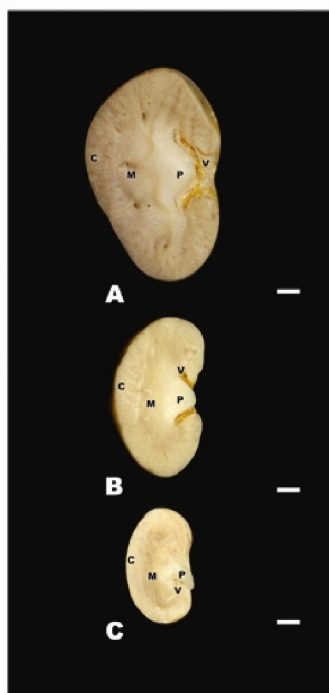
Table (1): Body weights (BW), absolute kidney weights (AKW), relative kidney weights (RKW), Corticomedullary thickness; cortex (C), absolute medullary thickness (AMT), relative medullary thickness (RMT) and length of renal papillae (RP) of guinea pigs (*Cavia porcellus*), Ethiopian hedgehogs (*Paraechinus aethiopicus*) and Golden spiny mice (*Acomys russatus*). All the data are represented as means  $\pm$  standard errors. Numbers in parentheses are the numbers of the experimental animals.

Experimental Animals	BW (g)	Kidney weight (g)				Corticomedullary thickness						RP (cm)	
		AKW		RKW		C (cm)		AMT (cm)		RMT			
		R	L	R	L	R	L	R	L	R	L	R	L
1- Guinea pigs ( <i>Cavia porcellus</i> ) (9)	380 ± 24.3	1.3± 0.08	1.3± 0.08	0.03± 0.001	0.03± 0.001	0.4 ± 0.03	0.4 ± 0.04	0.5± 0.03	0.5± 0.02	2 ± 0.4	2.1 ± 0.2	0.5± 0.02	0.4± 0.01
2- Hedgehogs ( <i>Paraechinus aethiopicus</i> ) (9)	186.1± 9.9	1± 0.04	1± 0.04	0.05± 0.003	0.05± 0.002	0.3± 0.02	0.3 ± 0.02	0.7 ± 0.06	0.7 ± 0.04	4 ± 0.6	3.8 ± 0.2	0.8 ± 0.06	0.7 ± 0.03
3- Spiny mice ( <i>Acomys russatus</i> ) (9)	22.7 ± 1.4	0.2± 0.01	0.1 ± 0.01	0.07± 0.006	0.05± 0.006	0.2 ± 0.01	0.2 ± 0.01	0.3 ± 0.02	0.3 ± 0.01	10.8± 1.2	8.1± 1.4	1 ± 0.03	0.9 ± 0.02
Probability (1) vs (2)	P < 0.001 (S)	P<0.01 (S)	P < 0.001 (S)	P<0.01 (S)	P < 0.05 (S)	P < 0.05 (S)	P> 0.05 (NS)	P<0.01 (S)	P < 0.001 (S)	P > 0.05 (NS)	P > 0.05 (NS)	P > 0.05 (NS)	P<0.01 (S)
(1) vs (3)	P < 0.001 (S)	P < 0.001 (S)	P < 0.001 (S)	P < 0.001 (S)	P<0.01 (S)	P < 0.001 (S)	P < 0.05 (S)	P<0.01 (S)	P < 0.001 (S)	P < 0.001 (S)	P < 0.001 (S)	P < 0.01 (S)	P < 0.05 (S)
(2) vs (3)	P < 0.001 (S)	P < 0.001 (S)	P < 0.001 (S)	P < 0.05 (S)	P > 0.05 (NS)	P < 0.05 (S)	P > 0.05 (NS)	P < 0.001 (S)	P < 0.001 (S)	P < 0.001 (S)	P<0.01 (S)	P < 0.001 (S)	P < 0.001 (S)

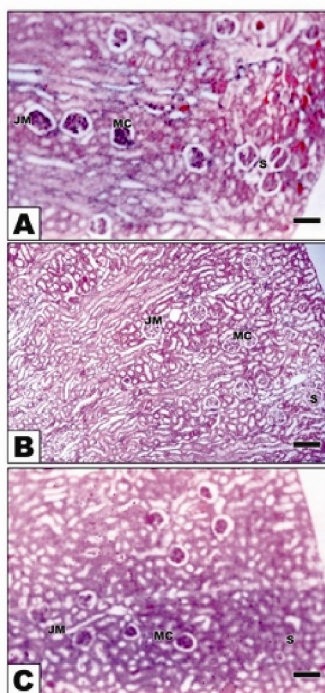


Table (2) : Number of nephrons per whole kidney (WK), per gram kidney weight (GKW) , per gram body weight (GBW) , glomerular volumes ( $\text{mm}^3$ ) of superficial (S), mid-cortical (MC) , juxta-medullary (JM) nephrons as well as JM/S ratio of glomerular size and total glomerular volume (GV) ( $\text{mm}^3$ ) of guinea pigs (*Cavia porcellus*), Ethiopian hedgehogs (*Paraechinus aethiopicus*) and Golden spiny mice (*Acomys russatus*). All the data are represented as means  $\pm$  standard errors. Numbers in parentheses are the numbers of the experimental animals.

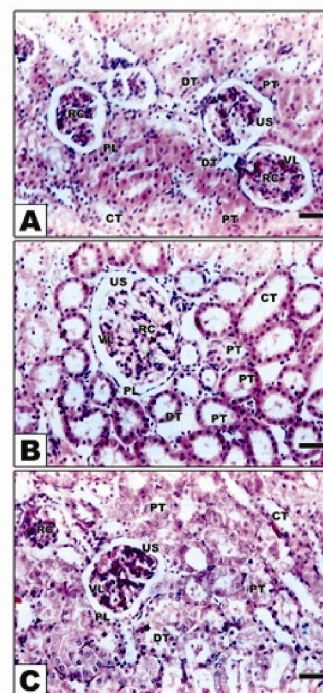
Experimental Animals	Number of nephrons			Size of different glomerular Populations ( $\mu\text{m}^3$ )				Total glomerular volume per gram body weight (GV) ( $\text{mm}^3$ )
	WK	GKW	GBW	S	MC	JM	JM/ S	
1-Guinea pigs ( <i>Cavia porcellus</i> ) (9)	29367 $\pm$ 3961.8	2232 3.6 $\pm$ 4904.8	74.2 $\pm$ 7.3	204 $\pm$ 42	391 $\pm$ 36.9	661 $\pm$ 79	3.24 $\pm$ 1.59	32.34 $\pm$ 4.2
2- Hedgehogs ( <i>Paraechinus aethiopicus</i> )	43932.3 $\pm$ 2168.4	41331.7 $\pm$ 2472.8	238.2 $\pm$ 12	170.7 $\pm$ 29.3	386.2 $\pm$ 81.9	737.7 $\pm$ 68.6	4.32 $\pm$ 1.43	101.87 $\pm$ 15.9
3- Spiny mice ( <i>Acomys russatus</i> ) (9)	1569 $\pm$ 235	15640 $\pm$ 305	58.9 $\pm$ 12	132.1 $\pm$ 16.4	171 $\pm$ 29.4	460.3 $\pm$ 24.8	3.48 $\pm$ 1.54	17.58 $\pm$ 3.5
Probability (1) vs (2)	P<0.01 (S)	P<0.01 (S)	P<0.001 (S)	P> 0.05 (NS)	P> 0.05 (NS)	P> 0.05 (NS)	P> 0.05 (NS)	P< 0.01 (S)
(1) vs (3)	P< 0.001 (S)	P<0.001 (S)	P< 0.001 (S)	P> 0.05 (NS)	P< 0.05 (S)	P> 0.05 (NS)	P> 0.05 (NS)	P<0.001 (S)
(2) vs (3)	P< 0.001 (S)	P<0.001 (S)	P<0.001 (S)	P> 0.05 (NS)	P< 0.05 (S)	P< 0.05 (S)	P> 0.05 (NS)	P<0.001 (S)



**Fig.1**



**Fig.2**



**Fig.3**

Fig.1: Photomicrograph of cross mid-sagittal sections of the kidney of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing cortex (C), medulla (M), renal papilla (P) and renal pelvis (V). X 10.

Fig.2: Photomicrograph of transverse sections of the kidney of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing the main nephron populations (S, MC and JM). H&E X100.

Fig.3: Photomicrograph of transverse sections through the cortical region of the kidney of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing renal corpuscles (RC) and tubules (PT, DT and CT). H&E X250.



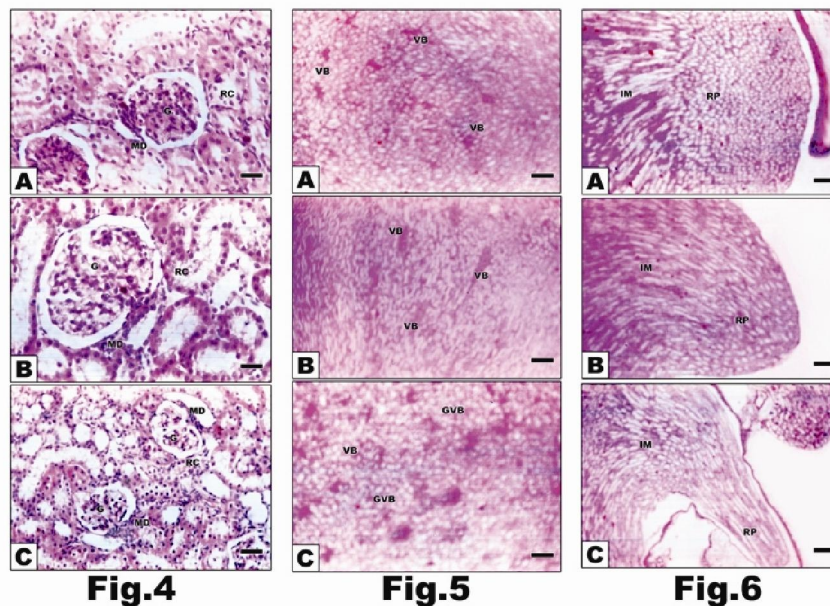


Fig.4: Photomicrograph of transverse sections through the cortical region of the kidney of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing macula densa (MD). H&E X 300.

Fig.5: Photomicrograph of transverse sections of the kidney of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing simple vascular bundles (VB) and giant type (GVB). H&E X 100.

Fig.6: Photomicrograph of transverse sections of the kidney of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing shapes of renal papillae (RP). H&E X40.

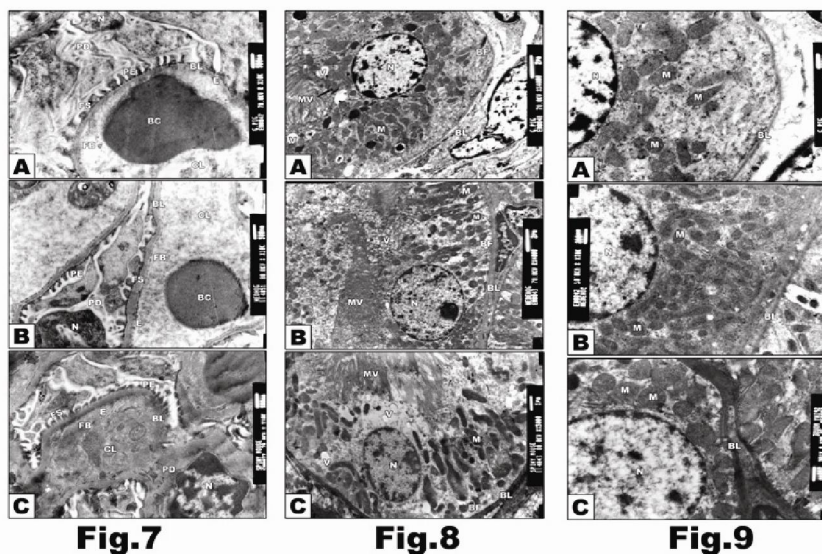


Fig.7: Electron micrograph of the renal corpuscle of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing capillary loops (CL), endothelium (E), pedicles (PE), basal lamina (BL), filtration slits (FS) and filtration barrier (FB). X10000.

Fig.8: Electron micrograph of the epithelial lining of the proximal tubule segment of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing microvilli (MV), mitochondria (M), vacuoles (V) and nucleus (N). X7500.

Fig.9: Electron micrograph of the epithelial lining of the distal tubule segment of the guinea pig (A), the hedgehog (B) and the spiny mouse (C) showing mitochondria (M) and basal lamina (BL). X7500.

#### 4. Discussion:

It has been well established that water availability is limited, or scarce, in arid and semi-arid habitats. Thus the different animal species live in these environments are faced with the problem of water conservation. Thereby, the efficient water economy can be examined through the ability of the kidney to produce a concentrated urine (Weissenberg & Shkolnik, 1994).

Although there is a strong correlation between the structure of the mammalian kidney and urinary concentrating ability (Cooper & Withers, 2010). However, it appears difficult to build a coherent picture of the concentrating system of the mammalian kidney. This may be due to the diversity of the factors involved and to considerable interspecies differences.

In the present study, the body weights of the different examined species were distinctly varied; with the guinea pigs had the heaviest body weight followed by the hedgehogs then the spiny mice which had the lightest body weight. The present findings go parallel with the concept that small species have more powerfully-concentrating kidneys than do large species (Yang & Bankir, 2005). Another feature that deserves attention is the scaling of food intake/metabolic rate according to size (Smith, 1984). The smaller the size, the higher are these parameters and the higher the excretory needs in relation to body weight.

The absolute kidney weights of the selected animals followed the same pattern of the body weights; the guinea pigs showed the highest values followed by the hedgehogs then the spiny mice which had the lowest values. The relative kidney weights followed an opposite pattern; with the spiny mice had the highest value followed by the hedgehogs then the guinea pigs which had the lowest values. These observations may be related to the high water content of vegetables; the sole diet of the guinea pigs. So, these animals did not need to conserve water. In contrast, both the spiny mice and the hedgehogs might require larger relative renal tissue to satisfy their water needs from a less liquid diet. Further support of such findings comes from the concept that the smaller animals would need greater renal concentration powers to conserve water (Gordge and Roberts, 2008), since they have exposed surface areas proportionality greater to the total water content. Therefore, they could desiccate more rapidly.

The relative medullary thickness has been used as an index of an organism's ability to generate hypertonic urine and, thus, as an adaptation to xeric habitats. Consequently, it is expected that species with high RMT indices will be able to increase their urine concentration during spells of drought that lead

to increase salinity of water sources. However, the relative thickness of the medulla accounted for only 59% of the variability among species in concentrating ability, indicating that there are other morphological or physiological factors that significantly influence urine concentrating ability (Beuchat, 1990).

In the present study, the renal cortico/medullary thickness as well as the relative medullary thickness among different studied species were distinctly varied, with the spiny mice had the highest values of RMT followed by the hedgehogs then the guinea pigs which showed the lowest values.

The present data are consistent with the results of Coleman & Downs (2009) and Cooper & Withers (2010) who reported that the relative medullary thickness of the different mammalian species inhabiting arid and semiarid environments was significantly higher in comparison to that of the species inhabiting mesic area. The present findings concerning the relative medullary thickness may be attributed to the different nature of either diet and/or habitat of the studied animals. Such suggestion comes from the study of Casotti *et al.* (2005) who reported that the shift from insectivory to frugivory and nectarivory in bats from different habitats was accompanied by a reduction in RMT, a reduction in the percent of renal medulla, and an increase in the percent of renal cortex. Moreover, close correlation between the relative medullary thickness and the availability of water in the animal's environment has been mentioned by Dickinson *et al.* (2005) and El-Gohary (2009).

The renal papilla of the spiny mice kidney was markedly sharp pointed, longer and extended down into the renal pelvis comparing to the corresponding papillae of both the hedgehogs and the guinea pigs which were relatively shorter and blunt. These results agree with the lengthening of the papilla in case of *G. gerbilus* (Ismail, 1997) and sand rat (El-Bakary, 2000). Also, these observations are parallel to that recorded in the hedgehogs by Altschuler *et al.* (1979). They cited that a broad (blunt) papilla may be necessary to produce a large urine volume, whereas a narrow pointed papilla may be better adapted to concentrate urine down to a small volume.

Moreover, the present data give further support to the view that a slender papilla has been found typical in desert rodents often exposed to conditions of water shortage (El-Gohary *et al.* 2008 and El-Gohary 2009).

In the present investigation, the renal pelvis of the guinea pigs was of simple type. On the other side, the spiny mice and the hedgehogs had very specialized form of renal pelvis. It penetrates the

inner stripe with many complexity shaped extensions, which surround the giant vascular bundles.

The kidneys of the different investigated animal species showed three types of nephron populations. The glomeruli of all the nephron populations of the spiny mice kidneys were distinctly smaller than the corresponding glomeruli of both the guinea pig and hedgehog kidneys. The recorded results are consistent with the studies of Dickinson *et al.* (2007) and El-Gohary (2009).

The number of nephrons was varied among examined species; with the hedgehog kidneys had the highest values followed by the guinea pigs then the spiny mice which had the fewest number of nephrons. Such data are in a good agreement with the results obtained by El-Beltagy (2002) who showed that bats inhabiting mesic environment had nearly three times as many nephrons as those living in arid zone. Also, few number of nephrons was recorded in many rodent species inhabiting arid habitats as reported by Altschuler *et al.* (1979) on the pocket mouse, *Perognathus penicillatus*, El-Gohary *et al.* (1992) on *G. gerbilus*, El-Bakary (2000) on *Psammomys obesus*, Dickinson *et al.* (2007) on spiny mice, El-Gohary *et al.* (2008) on insectivorous bats and El-Gohary (2009) on bandicoot rats. Thus the fewer number of nephrons may be considered as an evolutionary trend that favors the elaboration of a small volume of concentrated urine in desert adapted species and subsequently could contribute to a successful water economy (Dickinson *et al.*, 2007).

On the other side, kidneys of rodents from mesic environment have relatively high density of glomeruli (El-Beltagy, 2002). Therefore, guinea pigs with a predominantly vegetable diet with high water content need to filter a greater volume of fluid than do spiny mice with a predominantly relatively dry diet with relatively low water content. Thus greater number of nephrons in the guinea pig kidneys may be necessary to handle large volumes of glomerular ultrafiltrate.

The JM/S ratio of glomerular size of the insectivorous hedgehogs was higher followed by the spiny mice and then the guinea pigs. Such findings may lead to preferential filtration in these juxta-medullary nephrons and because they have long loops may result in higher concentrating capacity. The present observations are in agreement with the results of Ismail (1997) who recorded that JM/S ratio for glomerular size was particularly higher in desert than in non desert species.

The total glomerular volumes per gram body weight of the spiny mice was distinctly smaller than those of the guinea pigs and the hedgehogs. Such findings may be attributed to both the fewer number and smaller size of glomeruli in the spiny mice in

comparison with the other studied species. Therefore, the relative smaller filtration surface area of the spiny mice may assume certain adaptive considerations, since the glomerular filtration rate (GFR) may be basically depended upon the external surface area of glomeruli.

In the present work, the inner stripe of the outer medullary zone of the spiny mice was markedly developed. It consists of two distinct compartments, that of the giant vascular bundles and that of the interbundle regions. The giant vascular bundles consist of arterial vasa recta, venous vasa recta and the thin descending limbs of the short loops of Henle. The observed data are in agreement with the studies of (El-Bakary (2000) on *Psammomys obesus*, Dickinson *et al.* (2007) on spiny mice, El-Gohary *et al.* (2008) on insectivorous bats and El-Gohary (2009) on bandicoot rats who reported that the inner stripe of the outer medulla of the desert inhabited mammalian species had high frequency of well-developed giant vascular bundles.

The fenestrated endothelial cells, the filtration slits and the glomerular basal lamina formed the filtration barrier, the thickness of which was markedly varied among the examined species. The spiny mice showed the greatest thickness followed by the hedgehogs then the guinea pigs which had relatively thin filtration barrier.

In addition, the spiny mice had relatively low density of narrow filtration slits. However, the guinea pigs showed high density of obviously wide filtration slits comparing to the other species. Similar observations have been recorded on different mammalian species by El-Gohary *et al.* (2008) and El-Gohary (2009). In addition, the present observations are in accordance with the results of Safer *et al.* (1988) who reported that, in an arid habitat in which the organism is subjected to long periods of water deprivation, a thick basal lamina would provide strong mechanical support to the glomerular capillaries against the extremes of the concentration and dilution of the blood and assist in keeping the lumens of the capillary loops open in hypertonic environment of the medullary interstitium. Further confirm of the present observations comes from the findings of Safer *et al.* (1988) on *Meriones crassus*, Ismail (1997) on *Gerbilus gerbilus* and El-Bakary (2000) on *Psammomys obesus*.

The ultrastructure of the epithelial lining of the proximal tubule of the spiny mice showed well developed brush border of numerous long microvilli and fewer small endocytic vesicles, huge numbers of elongated mitochondria with distinct densely packed cristae. In addition, the basal lamina of the proximal epithelial lining of the spiny mice was distinctly thicker compared to those of the hedgehogs and the



guinea pigs. These observations go parallel with the findings of Kaissling *et al.* (1977) on *Psammomys obesus*, Tsujii *et al.* (1992) on *Platypus* and El-Bakery (2000) on sand rat.

The presence of a well developed long microvilli play an important role in the increment of the surface area exposed to the lumen to facilitate the movement of large fluid volumes and to absorb a large proportion of fluid from the glomerular filtrate to maintain water balance of arid inhabitant species as previously reported by Bon & Fawcett (1986).

In the present study, the high density of mitochondria, the well developed basal infoldings of the epithelial lining of the distal tubules of the spiny mice reflects the active site and high degree of electrolyte transport (Kaissling and Le Hir, 1982), since the distal tubules are mainly involved in sodium reabsorption from the tubular fluid as mentioned by Burkitt *et al.* (1993). These observations are in a good agreement with the findings of Kriz *et al.* (1978) and Kaissling (1982). Moreover, the markedly thick basal lamina of the epithelial lining of both proximal and distal tubules of the spiny mice support the previous observations of Safer *et al.* (1988) who reported that the nephron of the one-humped camel *Camelus dromedarius* is unique in having an unusually thick basal lamina underlying the epithelial cells of the nephron.

Since the investigated species of the present study inhabit vastly different environments, their osmoregulatory demands are quite different. Thus, the recorded striking differences in the renal morphological, anatomical, histological and ultrastructural aspects between the selected arid - and mesic - zone species are consistent with a need to conserve water and /or ions respectively. However, much more must be learned about the genetic factors which consequently may help in illuminating details of interspecific variations in renal concentrating capacity among mammalian species.

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## Efficacy of Neural Mobilization in Treatment of Low Back Dysfunctions

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**Abstract:** The study was conducted to investigate the effect of lumbar mobilization techniques and neural mobilization technique on sciatic pain, functional disabilities, centralization of symptoms in patients, latency of Hoffmann reflex, and of degree of nerve root compromise in chronic low back dysfunction (LBD). Pre-test post-test group design has been used. Sixty patients with chronic (LBD) from both sexes were involved, aged between 30 – 60 years. They were divided into two equal groups, Group (A) received lumbar spine mobilization and exercise intervention and Group (B) received Straight leg raising stretching (SLR) in addition to lumbar mobilization and exercise. Self-report measures included a body diagram to assess the distribution of symptoms, numeric pain rating scale (NPRS), modified Oswestry Disability Index (ODI), Patients recorded the location of their symptoms on the body diagram to determine the extent to which centralization occurred after treatment, The results of study revealed that: there was a significant difference between both groups on pain ( $p = 0.006$ ), functional disabilities improvement ( $0.001$ ), location of symptoms ( $p = 0.083$ ) and sciatic nerve root compression ( $p = 0.035$ ). However there is no significant Differences in H-reflex latency ( $p = 0.873$ ) between group A and group B (post test). It is concluded that straight leg raising (SLR) stretching may be beneficial in the management of patients with LBD. SLR stretching in addition to lumbar spine mobilization and exercise was beneficial in improving pain, reducing short-term disability and promoting centralization of symptoms in this group of patients.

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**Key words:** Chronic low back dysfunction, Straight leg raising (SLR) stretching, lumbar mobilization, H-reflex latency.

### Introduction

Lumbar-spine disorders rank fifth among disease categories in the cost of hospital care and account for higher costs resulting in absent from work and disability than any other category <sup>(1)</sup>. Disability associated with low back dysfunction (LBD) continues to rise, contributing to a substantial economic burden that exceeds nearly 50 billion annually in the United States alone. Health care expenditures among individuals with LBD are also 60% greater than those without LBD with 37% of the costs a direct increase of physical therapy services <sup>(2)</sup>. Physical therapists utilize a wide range of interventions in the management of LBD; however, evidence for the effectiveness of these interventions is limited <sup>(3)</sup>. Intervention in patients with a disease requires that the intervention has to be more beneficial, safer, and cost-effective compared with the untreated natural history. Intervention should occur after accurate diagnosis and consideration of prognostic findings. This dilemma is particularly important in patients with low back dysfunction (LBD) with or without radiculopathy <sup>(4)</sup>.

The SLR test is frequently used in the assessment of patients presenting with lumbar spine dysfunction and is one of the few indicators that has been shown to identify the degree of impairment from LBD" Furthermore, it has been suggested that

improving the range of SLR has a beneficial effect in restoring normal movement and reducing the degree of impairment due to low back dysfunction <sup>(5)</sup>. Unfortunately, there is no research evidence to support these conjectures. The movement of SLR induces posterior pelvic rotation and thereby flexion of the lumbar spine as well as flexion of the hip. The study was conducted to investigate the effect of lumbar mobilization techniques and neural mobilization technique (SLR stretch) and on sciatic pain, functional disabilities, centralization of symptoms in patients, latency of Hoffmann reflex, and of degree of nerve root compromise in chronic LBP with lumbar radiculopathy (sciatica).

### Subjects

Sixty patients with chronic (LBD) from both sexes were involved, aged between 30 – 60 years. They were divided into two equal groups, Group (A) received lumbar spine mobilization and exercise intervention and Group (B) received Straight leg raising stretching (SLR) in addition to lumbar mobilization and exercise. Patients were required to have symptoms that referred distal to the buttocks, reproduction of the patient's symptoms with straight leg raise testing, no change in symptoms with lumbar flexion or extension, and a baseline Oswestry score greater than 10%. Patients with "red flags" for a

serious spinal condition (e.g. infection, tumors, osteoporosis, spinal fracture, etc.) were excluded. Also patients who were pregnant, has a history of spinal surgery, positive neurologic signs or symptoms suggestive of nerve root involvement (diminished upper or lower extremity reflexes, sensation to sharp and dull, or strength), osteoporosis, or exhibited a straight leg raise (SLR) test of less than 45° were also excluded.

### Design of the study:

The design of study was pre-test post-test group design with dependant variables were pain level, functional disabilities, amplitude of Hoffmann reflex, and degree of nerve root decompression, The independent variables were neurodynamic techniques, and lumbar mobilization.

### Instrumentation

#### 1- Magnetic resonance imaging (MRI):

Magnetic resonance imaging (MRI) was used to measure degree of nerve root compression by disc herniation using grading system. The system was used in grading compromise of the intraspinal extradural lumbar nerve root consists of four grade categories. Grade 0 (normal): No compromise of the nerve root is seen. There is no evident contact of disk material with the nerve root, and the epidural fat layer between the nerve root and the disk material is preserved. Grade 1 (contact): There is visible contact of disk material with the nerve root, and the normal epidural fat layer between the two is not evident. The nerve root has a normal position, and there is no dorsal deviation. Grade 2(deviation): The nerve root is displaced dorsally by disk material. Grade 3(compression): The nerve root is compressed between disk material and the wall of the spinal canal; it may appear flattened or be indistinguishable from disk material <sup>(6)</sup>.

The main reason for MRI referral of patients with chronic radicular pain below the knee without a history of neoplasm, infections, or other rare abnormalities is to distinguish between patients with and without herniated disks. This distinction requires accurate imaging because small herniations can be difficult to detect. The accuracy of MRI for predicting the presence of disk herniations at surgery is relatively high (varying from 76% to 96%), and thus it has become the investigation of choice for patients suspected of lumbar disk herniations <sup>(7)</sup>.

#### 2- NeuroScreen plus Electromyography:

NeuroScreen plus Electromyography system was designed to measure electromyography and electroneurography parameters. In this study latency of Hoffmann reflex (H-reflex) was measured.

Essentially the Neuroscreen plus system consists of the following components: Computer-incl. A/D converter and control board, 4 channels AC amplifier (floating), Tele panel (control panel), Ink-jet printer. Programmable neuroscreen plus software, and Neuroscreen plus kit: Composed of the following accessories: Cotton, alcohol, scissors, adhesive plaster, and medical gel, Recording, referencing, stimulating, and grounding electrodes with grounding strap.

### Procedures:

#### A- Evaluative procedure

Patients completed a variety of self-report measures, followed by a standardized history and physical examination performed by a physical therapist. Self-report measures included a body diagram to assess the distribution of symptoms, numeric pain rating scale (NPRS), modified Oswestry Disability Index (ODI), Patients recorded the location of their symptoms on the body diagram to determine the extent to which centralization occurred after treatment, which was determined according to the procedures described by Werneke *et al* <sup>(8)</sup>.

The standardized history consisted of demographic information including age, gender, past medical history, location and nature of symptoms, relieving/aggravating activities, prior episodes, occupation and leisure activities. The standardized physical examination included measurements of active lumbar range of motion, passive posteroanterior mobility of the lumbar spine <sup>(9)</sup>, myotomal testing, sensory examination to sharp and dull, muscle stretch reflex testing, the SLR test <sup>(10)</sup>. The evaluative instruments included:

#### 1-Health scale device:

Health scale device used to measure the weight and the height for each patient

#### 2- Pain assessment

The 11-point NPRS ranges from 0 ("no pain") to 10 ("worst pain imaginable") and was used to indicate the intensity of current pain and at its best and worst level over the last 24 h <sup>(11)</sup>. These 3 ratings were averaged to arrive at an overall pain score. The scale has been shown to have adequate reliability, validity, and responsiveness in patients with LBP when the 3 scores are averaged <sup>(12)</sup>.

#### 3- Functional disability

The functional disability of each patient was assessed by Oswestry disability questionnaire. It consists of 10 multiple-choice questions of LBP included disability in daily function and leisure time

activities, for each question the patient select one sentence out of six that best describe his disability. For each section of six statements the total score is 5, if the first statement is marked, the score is zero, if the last is marked the score is 5. The final score calculated as follow: Total score= (5x number of questions answered) x 100%. The test-retest reliability of the modified ODI has been shown to be high (ICC  $\frac{1}{4}$  .90) <sup>(13)</sup>.

#### 4- Location of the symptoms:

The most distal extent of symptoms were coded as occurring in the low back, buttock/thigh, or distal to the knee by placing a transparent overlay of the scoring grid over the patient's body diagram. A score of (0) was given if there was no identification of symptoms, (1) if pain was isolated to the central low back, (2) if pain was indicated in the lateral low back, (3) if pain was located in the buttocks, (4) if pain was located in the upper leg, (5) if pain was located in the lower leg, and (6) if pain was located in the foot. This procedure has been shown to exhibit excellent reliability (k  $\frac{1}{4}$  .92) <sup>(8)</sup>.

#### 5- Measurement of H-reflex:

##### Preparation of the skin

In order to reduce the skin impedance, the skin overlying the sites of the recording electrodes were shaved if necessary, the skin was rubbed lightly with sand paper to desquamate the surface and finally was rubbed with alcohol.

##### Position of the electrodes and their application

The recording electrodes consist of R1 placed over the soleus and R2, the reference electrode, placed over the Achilles tendon. Although the H-reflex can be recorded over any portion of gastrocnemius and soleus muscles, the optimal location that yields the largest H-reflex was two or three fingerbreadth distal to where the soleus meets the two bellies of the gastrocnemius. The tibial nerve was stimulated in the popliteal fossa, with cathode placed proximal to anode and beginning at very low stimulus intensities. Ground electrode (G) placed at half distance between stimulating and recording electrodes Silver-silver chloride surface electrodes were used and the recording electrodes will be fixed to the skin by adhesive plaster, which must not be so tight as to impair contraction or the circulation of the muscles as shown in figure (1) <sup>(14,15)</sup>.

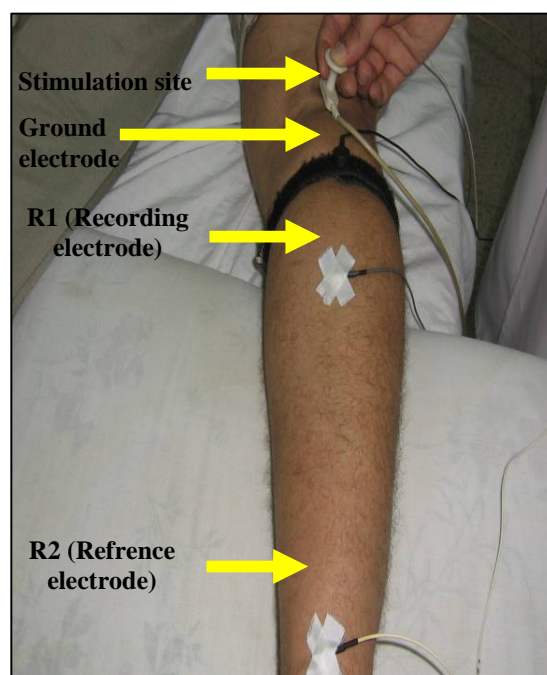
##### Position of the patient during recording:

The H-reflex latency was recorded while the patient was laid down in a prone lying position in a quiet room on a comfortably bed. The head maintained in mid position to control the possible

effects of asymmetrical tonic reflex. The examined leg was placed mid-way between abduction and adduction at hip joint. The knees was slightly flexed 20° degrees by placing a small cushion under the knee to relax the gastrocnemius to reduce any depressive influence on the H-reflex and ankle was freely positioned in planterflexion outside the plinth <sup>(14,15)</sup>.

#### Stimulation:

The H-reflex was elicited by stimulation of the posterior tibial nerve at the popliteal fossa little bit to lateral aspect by stimulating electrode as shown in figure (1).



**Figure (1): Stimulation site for tibial nerve (Posterior view)**

#### Recording site:

Soleus muscle: Posterior calf with recording electrode (R1) placed one to two fingerbreadths distal to where the soleus meets the two bellies of the gastrocnemius. Reference electrode (R2) placed over the Achilles tendon. The Stimulator pulse duration should be set at (1 ms) to more selectively activate the Ia sensory fibers. H reflex occurs with low stimulation intensities.

#### 6- Measurement of degree of nerve root compromise.

By using magnetic resonance imaging (MRI), One observer (Radiologist) interpreted the MRI finding (degree of sciatic nerve root compression) pre and post treatment. The observer

(Radiologist) was blinded about selection of patients and type of treatment during the reading of MRI. Before MRI exam, remove all accessories including hair pins, jewelry, eyeglasses, hearing aids, wigs and dentures. During the exam, these metal objects may interfere with the magnetic field, affecting the quality of the MRI images taken. Depending on how many images are needed, the exam generally takes 15 to 45 minutes. However, very detailed studies may take longer. Patient must lie down on a sliding table and be comfortably positioned. Even though the technologist must leave the room, Patient was asked to remain still during the actual imaging process; however, between sequences, which last between 2-15 minutes, slight movements were allowed. Luckily during the scans, there was no pain; however, some patients find the loud knocking and tapping sounds to be bothersome. Ear plugs were provided to avoid such annoyances.

## **B. Treatment procedure:**

### **Mobilization and exercise group (Group A):**

The lumbar spine mobilization and exercise intervention group performed a 5-min exercise warm-up at the beginning of each treatment. Following the warm-up patients received lumbar spine mobilization and completed a standardized exercise regimen since a combination of manual therapy and exercise have been shown to be effective in reducing disability in patients with chronic LBP <sup>(16)</sup>. The physical therapist performed posteroanterior mobilizations to hypomobile lumbar spine vertebrae segments as determined on the initial evaluation. Grades III-IV mobilizations were selected based upon the patient response and the physical therapist's clinical reasoning <sup>(9)</sup>. Patients also completed a standardized exercise program consisting of pelvic tilts, bridging, wall squats, quadruped alternate arms/legs activities as described by Childs *et al* <sup>(12)</sup>, which has been shown to result in clinically meaningful improvements in disability. Patients were asked to perform 2 sets of 10 repetitions of each exercise. The physical therapist progressed the patient's exercise routine according to the patient's symptoms.

### **SLR stretching group (Group B)**

Patients in the SLR-stretching group completed the identical warm-up followed by lumbar spine mobilization and the identical standardized stabilization exercise program, but also received SLR-stretching exercises that were provided by the physical therapist. One investigator performed SLR on all the subjects. The SLR test was performed as described by Butler, and Jones <sup>(17)</sup>. The patient was supine and relaxed in the center of the bed, with one pillow under the head. The trunk and pelvis should

were in neutral position. While the therapist was standing beside the affected side, he began to raise the affected side perpendicular to the bed in standard SLR test with one hand placed under the ankle joint and the other hand placed above the knee joints until either pain in the back or referred pain to the leg restricted the movement. Then the lower limb was taken down few degrees from this symptomatic point. The therapist started to stretch (mobilize) the sciatic nerve by a sequence of gentle oscillations toward ankle dorsiflexion and then reassessed the effect. The number of these sequences was repeated several times, through which the amplitude of the technique was increased according to the patient response. The technique was progressed to a point where symptoms were reproduced, or it was taken to a point where resistance of the movement was encountered. The technique was repeated with sciatic nerve was more tensed through variations as: Ankle planter flexion and inversion. Hip adduction and medial rotation. As the pain was relieved, the therapist increased the range of motion until reaching the maximum range of SLR with pain free <sup>(18)</sup>. The position was held for 30 s. A total of 5 repetitions were completed. The time spent performing the SLR stretching added only 3-4 min to the total treatment time, thus the potential for an attention effect to exist is extremely low. The decision to use a treatment procedure that reproduced the patient's symptoms was based on a case series reported by George <sup>(19)</sup>. In this study patients exhibiting a positive SLR test in the absence of radicular symptoms were subjected to SLR stretching following a brief warm-up, as a treatment protocol. A decrease in symptom intensity was observed following 5-12 treatment sessions.

### **Follow-up**

At the completion of 6 physical therapy sessions (3 weeks), an assistant who was unaware of group assignment or the nature of the study re-administered the self-report questionnaires. The potential for rater bias is further minimized based on the use of patient completed outcome measures.

### **Statistical design and data analysis:**

Sample size calculations were performed using SPSS statistical software (SPSS Inc., Chicago, IL). The independent variable was group (mobilization and exercise vs. SLR stretching), and the primary dependent variable was perceived disability as recorded by the ODI. Secondary dependent variables included centralization of symptoms and pain. Separate independent t-tests were used to assess differences between groups at discharge. The  $\alpha$ -level was divided equally between

dependent variables to maintain the family-wise  $\alpha$ -level equal to .05.

#### Results: Subject characteristics

##### Mobilization and exercise group (Group A):

Thirty subjects were included in this group 10 male and 20 female. The mean of the age of males was  $47 \pm 3.35$  years. The mean value of their weight was  $87.7 \pm 5.9$  kg and the mean value of their height was  $174.3 \pm 4.3$  centimeters. The mean of the age of females was  $43 \pm 6.7$  years. The mean value of their

weight was  $82.4 \pm 4.5$  kg, and the mean value of their height was  $161.2 \pm 4.03$  cm.

##### SLR stretching group (Group B)

Thirty subjects were included in this group 12 male and 18 female. The mean of the age of males was  $43.8 \pm 3.8$  years. The mean value of their weight was  $94.9 \pm 6.69$  kg and the mean value of their height was  $175.4 \pm 3.1$  cm. The mean age of females was  $42.5 \pm 6.5$  years and the mean value of their weight was  $81.7 \pm 7.7$  kg, and the mean value of their height was  $163.5 \pm 4.7$  cm.

**Table (1): Demographic data of all subjects**

Groups Variables	Mobilization and exercise group (Group A)	SLR stretching group (Group B)	t- value	P value
Age (years)	$44.2 \pm 6.16$	$42.93 \pm 5.73$	.0824	0.413
Weight (kg)	$84.05 \pm 10.73$	$86.1 \pm 9.67$	0.777	0.440
Height(cm)	$165.2 \pm 7.30$	$167.5 \pm 7.07$	1.239	0.220

\* Significance level  $\leq 0.05$

**Table (2) Self-report variables for both treatment groups (post test)**

Variable	Mobilization and exercise group (n = 30)	SLR stretching group (n=30)	t value	P value
Numeric pain rating score	$3.03 \pm 1.88$	$1.83 \pm 1.83$	2.86	0.006*
Oswestry Disability Index	$18.4 \pm 6.87$	$23.9 \pm 4.9$	3.54	0.001*
Location of symptoms	$4.3 \pm 0.83$	$3.9 \pm 0.77$	3.22	0.083

**Table (3): Differences in H-reflex latency between group A and group B (post test)**

H-reflex latency	Mobilization and exercise group (n = 30)	SLR stretching group (n=30)	t value	P value
	$28.82 \pm 3.02$	$28.93 \pm 2.42$	.160	.873

**Table (4): Differences in degree of sciatic nerve root compression between group A and group B (post test)**

Sciatic nerve root compression	Mobilization and exercise group (n = 30)	SLR stretching group (n=30)	t value	P value
	$.266 \pm .449$	$.533 \pm .507$	2.154	.035*

\* Significance level  $\leq 0.05$



**Discussion:**

The results of study confirm hypotheses that strait leg raising (SLR) stretching may be beneficial in the management of patients with LBD. SLR stretching in addition to lumbar spine mobilization and exercise was beneficial in improving pain, reducing short-term disability and promoting centralization of symptoms in this group of patients. This study was limited by several factors. First, the measurement of pain was limited to the available Numeric pain scale. Second, the effect of noise and any external waves may interfere with accuracy of Hoffmann reflex (Latency) in E.M.G lap. There is a significant difference in pain reduction in the mobilization and exercise group compared to the SLR stretching group. It has been reported that reductions in the Oswestry of 6 points or greater are considered clinically meaningful <sup>(13)</sup>. The change scores for both groups in our study confirm this clinically meaningful level ( $18.4 \pm 6.87$  in the mobilization and exercise group and  $23.9 \pm 4.9$  in the SLR stretching group).

Centralization of symptoms in patients with LBP indicates a favorable prognosis <sup>(20, 21)</sup> and is typically used to guide treatment in patients with low back and lower extremity symptoms. However, the SLR stretching technique used in this study was designed to reproduce the patient's symptoms, which sometimes resulted in a peripheralization of their symptoms. The decision to proceed with treatment despite the peripheralization of symptoms in this group is consistent with the treatment approach used by George <sup>(19)</sup>. In this study, SLR stretching resulted in significant improvements in disability and pain and centralization of symptoms compared to a lumbar spine mobilization and exercise program without SLR stretching. Therefore, perhaps centralization is not prognostic for a favorable outcome among all subgroups of patients with LBD. A few studies <sup>(18, 22, 23, 24)</sup> have investigated the effects of neural mobilization techniques on patients with LBD and lower extremity symptoms. Scrimshaw and Maher <sup>(24)</sup> investigated the effects of neural mobilization following lumbar dissection, fusion, or laminectomy. The results of a 12-month follow-up demonstrated that neural mobilization did not provide additional benefits to traditional postoperative care. However, the patients in this study exhibited a straight leg raise range of motion that was within normal limits suggesting that perhaps performing neural mobilizations on patients with a normal straight leg raise may not be beneficial in decreasing pain and disability.

There was no a significant difference between post test results of neurodynamic techniques and post test results of mobilization on H-reflex

(Latency), where neurodynamic techniques and mobilization have a same effect on H-reflex (Latency) where ( $p = 0.873$ ), and there was a significant difference between post test results of neurodynamic techniques and post test results of mobilization on the degree of sciatic nerve root compression ( $p = 0.083$ ). This comes with agreement with study done by Hoke <sup>(25)</sup>, who applied rotatory manipulation with the painful side uppermost and the top hip being taken forward and the shoulders backwards.

It was proved that neurodynamic techniques and mobilization have a role in treatment of chronic low back pain and radiculopathy. This comes in agreement with Burns, and Hangee <sup>(26)</sup>, who investigated the use of thrust, non-thrust mobilization/manipulation coupled with neurodynamic mobilization (neural mobilization) exercises for an individual with recurrent lower back pain. The patients experienced a rapid improvement in pain and functions after non-thrust and thrust manipulation to the lumbar spine and supine lower extremity neurodynamic mobilization (neural mobilization) techniques. A combination of thrust and non-thrust mobilization/manipulation and lower extremity neurodynamic mobilization techniques (neural mobilization) may be helpful in patients with chronic recurrent, low back pain with radicular symptoms.

It was clear that neurodynamic techniques (neurodynamic) has a great role in management of sciatica resulted from herniated disc concerning pain and restoring mobility of nerve root. This comes agreement with Cleland *et al* <sup>(27)</sup>, Gladson *et al* <sup>(28)</sup>, who mentioned that when the nerve root was compressed and microcirculation was compromised; and the pressure received by the nerve will affect the edema and the demyelination, neurodynamic techniques consists of short oscillatory movements and was sufficient to disperse the edema, thus alleviating the hypoxia and reducing the associated symptoms. It could also be directly associated with the immobilization reduction in the neurogenic inflammation. In addition, there is the hypothesis that nerve movement within pain-free variations can help to reduce nerve compression, friction and tension, therefore decreasing its mechanosensitivity. Therefore, a neurodynamic technique seems to be a better form of treatment when compared to passive stretching alone.

A Neurodynamic technique has a great role in management of radiculopathy and low back pain. It supported by McCracking <sup>(29)</sup>, who tested the long-term effects of a neurodynamic treatment technique for a patient with non-specific low back pain (LBP) and lower extremity (LE) pain. The study suggested

that neurodynamic treatment (neural mobilization) techniques may be useful in treating patients with low back and lower extremity pain who present with neural tension dysfunction. However, symptoms did not resolve substantially until introduction of a neurodynamic treatment technique. Also, slump stretching, was shown to be effective in the management of patients with non-radicular LBP when combined with lumbar mobilization and exercise.

The effect of neurodynamic techniques in exploration of sciatic nerve root from compression of disc herniation explained by McGill<sup>(30)</sup>, who stated that if the nerve root is impinged and cannot slide, instead of moving, the pain was elicited along the nerve trunk. The concept of nerve gliding plays a major role in formulating a treatment plan for nerve mobilization. Blood circulation and axonal transport, which are necessary for the functional and structural integrity of a neuron, will recover after the removal of the pressure by neurodynamic techniques was performed for reducing pressure caused by intraneural and extraneural fibrosis, increasing vascular and axoplasmic flow, and restoring tissue mobility<sup>(31)</sup>.

Improvement of H-reflex (Latency) post treatment due to mobilization was same to the effect of neural mobilization; this was due to small effect of mobilization on H-reflex latency and unclear clues that mobilization has a obvious effect on H-reflex latency. This comes in agreement with study done by Bulbulian *et al*<sup>(32)</sup> who investigated the effect of spinal mobilization on H-reflex measures, which revealed that Mean H-reflex amplitude was decreased and the H/M ratio was also decreased. However, Suter *et al*<sup>(33)</sup> stated that H-reflex responses after spinal manipulation are sensitive to movement/repositioning, and that the H-reflex depressions after manipulation documented in previous studies were movement artifacts rather than treatment effects. The relationship between etiology of low back pain and changes in H-reflex amplitude after spinal manipulation is not clear and needs further investigation.

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## Preparation of Ordered Nano-Titania Arrays and Electrodeposition of Nano- Hydroxyapatite Crystals on Ti-6Al%-4%V Dental Implant Surfaces

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**Abstract:** Nano-titania surfaces enhance rapid biointegration at bone/ implant interfaces. In this study, nanotechnology was employed to prepare Ti-6Al-4V dental implant surface. Titanium alloy discs were anodized at room temperature and heat treated (Group1). Then, electrodeposition technique was used to coat the anodized surfaces with hydroxy-apatite (Group2) followed by alkaline hydrothermal treatment (Group3). The different surfaces were characterized by XRD, IFM, SEM and FTIR. The results showed that anodization of Ti-alloy disks led to the formation of ordered nano-tubes arrays made of titanium oxide Anatase phase which acted as a template for the precipitation of nano-hydroxy-apatite crystals. Conclusion: anodization is a simple method to prepare ordered nano-titania that promoted the electrodeposition of highly nano- crystalline bioactive HA coating.

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**Key words:** anodization, nanotitania, anatase, electrodeposition, nanohydroxyapatite.

### 1. Introduction:

Establishing and maintaining mature bone tissue at the bone-implant interface is crucial for osseointegration and long-term success of the implants. Many studies have focused on chemical composition and characteristics of the surface to control bone healing around dental implants. Therefore, various surface modifications have been applied to Ti-6Al-4V implants in an attempt to enhance differentiation and promote direct contact between bone and implant material. None of these modifications have established a rapidly healed and stable interface that is strong enough to support functional loading for long periods, *Brett, et al 2004*.

A thin passivation layer formed on Ti- surface is composed of smooth and dense TiO<sub>2</sub>. Such a layer lacks desirable bioactive properties that cannot impart bone growth and strong chemical bonding. As well, there would be susceptibility for the formation of fibrous tissue that prohibits osteoblastic cells from firmly attaching onto the surface, and can cause inflammation and loosening of implant, *Salata, 2004*

Because of a nano-scaled structure of bone, it was expected that nano-structured TiO<sub>2</sub> would allow for an increase in bioactivity, *Alsberg et al, 2001*. Furthermore, the bioactivity and adhesion of osteoblasts on nano-grained titania and ordered nanoporous surface improved by about 20-30% compared with large-grain size, *Garcia et al, 2002*. Recently, a

novel nano-engineered surfaces were developed to provide better biological outcomes, *Brett, et al 2004*.

Titania nano-tube (TNT) arrays have attracted much attention because of their large specific surface area, favorable surface chemistry, and good biocompatibility. Among different methods used to prepare TNT such as assisted-templet method, sol-gel process and hydrothermal treatment, an electrochemical anodic oxidation was advantageous, *Ge Ruixia et al, 2008*. TiO<sub>2</sub> nanotubes produced by anodization are readily attached onto a titanium substrate in an ordered arrangement that is oriented and aligned perpendicular to the substrate offering much improved electron transfer, *Bayoumi et al, 2006*.

The solubility of the calcium phosphates coating into the of body fluids at the peri-implant region allow the saturation with the released ions to precipitate forming a biological apatite onto the surface of the implant, *de Groot et al, 1998 and Daculsi et al, 2003*. This layer of biological apatite contains endogenous proteins that serve as a matrix for osteogenic cell attachment and growth, *Davis et al, 2003* permitting the bone healing process around the implant and superior initial rate of osseointegration *Morris et al, 2000*. Accordingly, the biological fixation and the clinical success rate would be expected to be increased, *Geurs et al, 2002*.

Several techniques have been developed to coat metal implants surfaces with hydroxyapatite (HA); for example, plasma spraying, sputter-deposition, sol-gel coating, electrophoretic and electrochemical deposition and biomimetic precipitation. Using electrodeposition technique for Hydroxyapatite coating of Ti substrate avoid unwanted phase changes because of operating at low temperature and deposit complex architecture coating with controlled thickness. Most importantly, deposition of nano-structured HA crystals within the serrated TiO<sub>2</sub> nanotubes imparted higher bond strength, *Kar et al, 2006*.

Hence, this study aimed at preparing titania nano-tubes on the surface of Ti-6Al-4V alloy using anodization process prior to precipitation of HA coating via electrodeposition technique.

## 2. Materials and methods:

### I-Preparation of the samples:

#### I-1-Acid etching of Ti-alloy samples:

A total number of 15 Ti-alloy disks (*Modern techniques and material engineering center-America ELI [F130-84 alloy]*) representing three groups; five samples each, were utilized in this study. The disks dimensions were 6 mm in diameter and 2 mm in thickness. The disks were embedded in Epoxy resin block exposing an area of 28.3 mm<sup>2</sup> (r<sup>2</sup>). Stainless steel rod sheathed with Teflon for complete isolation when immersed in electrolyte solution was held to the block of each disk. The samples were fine polished using Emery paper starting from grit 600 to 1200 and were cleaned ultrasonically in deionized water for 5 minutes. The Ti-alloy disks were etched in mixture of 80 ml/l HNO<sub>3</sub>, 60 ml/l HF, and 150 ml/l H<sub>2</sub>O<sub>2</sub> for 5 min at room temperature. Again, the disks were ultrasonically cleaned in deionized water for 5 min and then dried by air drier.

#### I-2-Anodization and heat treatment of the samples:

Titania nano-tubes arrays were prepared on the disk surface by anodization. The anodization processes was carried out potentiostatically in designed electrochemical cell having two electrodes using a direct current (DC) source that was kept at constant voltage value of 20v. A platinum basket was used as cathode and Ti-alloy sample was connected as anode. The distance between cathode and anode was about 4 cm. A mixture of 1M.wt% HF and 1M H<sub>3</sub>PO<sub>4</sub> aqueous solution having, p 4.3 was used as an electrolyte, which was magnetically stirred with 120 rpm by using magnetic stirrer. The anodization process was performed for 45 min at room temperature. The samples were cleaned ultrasonically in deionized water for 5 min. Then, the samples were heat treated at 500°C for 3 hours with heating/cooling

rate of 30°C/min in Muffled electric oven with automatically regulated thermocouple according to *Bayoumi et al 2005*. Five samples were kept to represent Group1 without going through the other following steps.

#### I-3-Electro-deposition of calcium phosphate coating:

A single component cell was used to electrochemically deposit a calcium phosphate coating. The anodized heat-treated disks of Ti-alloy were served as a cathode and platinum basket of high purity was served as anode. The used electrolyte was basically a modified simulating body fluid as referred to *Ban and Marino, 1998*. The electrolyte was prepared by dissolving 0.042 mol/l Ca (NO<sub>3</sub>)<sub>2</sub>, 0.25 mol/l NH<sub>4</sub>H<sub>2</sub>PO<sub>4</sub> and 1.52 gm of MgCl<sub>2</sub>·6H<sub>2</sub>O in a deionized water. The p of the electrolyte was adjusted to be 3.6-4 approximately by the addition of Tris-buffer hydroxyl aminomethan- HCL. The employed cathodic current density was 0.1mA/cm<sup>2</sup> supplied by DC source. The electrodeposition process was carried out for 30 min using 90 rpm magnetic stirring in accordance to *Shoeib, 2004*. Five samples subjected to this step were kept to represent Group 2.

#### I-4-Hydrothermal treatment:

For phase transformation of precursor of HA; Brushite, the anodized heat treated samples were subjected to hydrothermal treatment according to *Nishio et al, 2000*. The surfaces of five samples represented Group 3 were positioned above boiled 1M NaOH solution for 1hour in a properly sealed beaker to be subjected to alkaline steam.

### II-Surface characterization:

Characterization of the prepared surfaces of each group was performed including identification of the composition of surface phases by X-ray diffraction (XRD) and Fourier transform infrared spectroscopic analysis (FTIR). As well, topographical study of the nanotubes surface texture with optical interference microscope (IFM) and examination of the surface morphology by scanning electron microscopy (SEM).

#### II-1-X- Ray Diffraction (XRD) analysis:

Thin film X-Ray diffractometer with a copper target (Cu<sub>k</sub> = 1.54060) and Nickel filter (PAN analytical,X'Pert Pro, Holand) was used in order to identify the constituents' phases of the disk surfaces and their average crystal size. The mathematical procedures were facilitated by computer soft ware (PSI-Plot, poly soft ware international, salt lake, UT). The data of XRD were based on Bragg's equation. The average crystal size of the constituents' phases of



the coating was calculated using Debye-Scherrer formula, *Kapczinski et al, 2003*.

## II-2-Fourier Transform Infrared (FTIR) analysis:

Using (FT/6300 type A. Jasco, Japan), the infra-red spectra of the surfaces treated samples were obtained in reflection % to analyze the chemical composition.

## II-3-Surface topographical study:

The length of Titania nano-tubes and their diameters were calculated by using optical interference microscope (IFM) (ZYGO Maxim-GP 200 profilometer). The evaluation of the surface roughness was carried out using surface optical profiler that traces the microstructure and topography of surfaces in three dimensions.

The selected samples were carefully ground and polished samples. Then, half of the sample surface area of the disk was isolated by a covering layer of nail polish to be electrically inconducive during the anodization according to *Vanzillotta, et al 2004*. After anodization of the exposed other half; two different regions could be clearly distinguished; an area of polished titanium-alloy surface and the other was purple in color representing anodic oxide film. Both regions were characterized by Scanning Probe Microscope (SPM) to image the topography.

## II-4-Scanning Electron Microscopic (SEM) examination:

The prepared Ti-alloy disks were sputter coated with gold- palladium using Hummer 5 sputter coater. SEM was used to examine the surface morphology of selected representative samples for each group at different magnifications (JEOL JSM 5410, Japan production).

## 3. Results

### I-Surface characterization of anodized heat treated titanium alloy (Group 1):

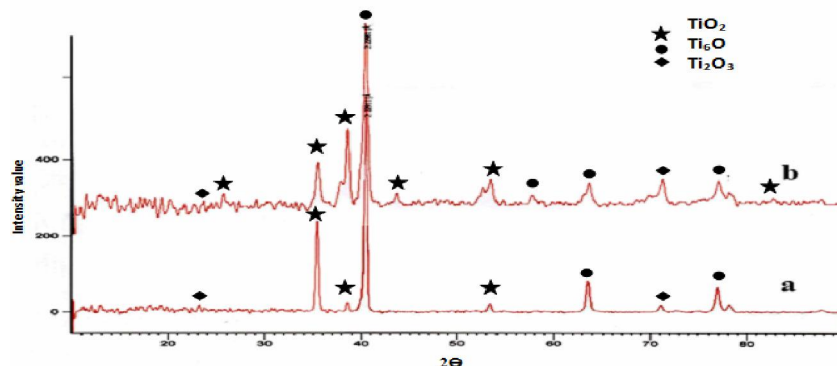
During the anodization process, it was observed that there was an oscillation in current density. An initial decrease in the current density occurred, and

then followed by steady period and finally slight increase took place that remained constant till the end of the process. As well, there was a change in color of the sample from metallic silver to be purple. Phases were identified for anodized samples prior to and after heat treatment using (XRD). Then, surface characterization was performed using (FTIR), (IFM) and (SEM).

### I-1-X-Ray diffraction (XRD) analysis:

XRD pattern of anodized Ti- alloy disks is shown in Figure (1-a). The peak values were compared with ICDD cards number 00-001-1118, 01-070-6826, and 01-071-1047 corresponding to  $\text{Ti}_6\text{O}$ ,  $\text{TiO}_2$ , and  $\text{Ti}_2\text{O}_3$  respectively. The results of anodized disks revealed that the surface was formed of these oxides. The maximum peak intensity of 100% was found at  $2\theta = 40.4673^\circ$  and  $d = 2.22982$  for  $\text{Ti}_6\text{O}$  phase. The sharp peak of  $\text{Ti}_2\text{O}_3$  were captured at  $2\theta = 38.6050^\circ$ ,  $d = 2.33225$  and  $I/I_0 = 4.56\%$ . Very small peak was detected for  $\text{TiO}_2$  anatase phase at  $2\theta = 47.5810^\circ$ ,  $d = 2.22911$  with  $I/I_0 = 0.41\%$ .

XRD of the heat treated anodized Ti- alloy disks at  $500^\circ\text{C}$  for 3 hours with heating / cooling rate  $30^\circ\text{C}/\text{min}$  is shown in Figure (1-b). ICDD 00-001-1118, 01-070-6826, 01-071-1047, and 01-072-5005 corresponding to  $\text{Ti}_6\text{O}$ ,  $\text{TiO}_2$ ,  $\text{Ti}_2\text{O}_3$  and  $\text{AlTi}_3$  respectively were compared with the obtained XRD patterns that revealed that the surface was formed of these oxides. The maximum peak intensity of 100% was located at  $2\theta = 40.46^\circ$ ,  $d = 2.22981$  for  $\text{Ti}_6\text{O}$  phase. Sharp peaks of  $\text{TiO}_2$  anatase were captured at  $2\theta = 25.5607^\circ$ ,  $d = 3.48503$ , with  $I/I_0 = 44.51\%$ . Another two peaks were also present at  $2\theta = 38.5764^\circ$ , and  $d = 2.3339$  with  $I/I_0 = 37.79\%$  and  $2\theta = 82.84^\circ$ ,  $d = 1.16531$  with  $I/I_0 = 37.53\%$ . Meanwhile only one peak for  $\text{Ti}_2\text{O}_3$  was captured at  $2\theta = 71.08^\circ$ ,  $d = 1.32$  with  $I/I_0 = 3.25\%$ .  $\text{AlTi}_3$  peaks were captured at  $2\theta = 63.62^\circ$ ,  $d = 1.46403$  with  $I/I_0 = 52.33\%$ ,  $2\theta = 63.5921^\circ$ ,  $d = 1.46316$  with  $I/I_0 = 12.21\%$  and  $2\theta = 63.62^\circ$ ,  $d = 1.46259$  with  $I/I_0 = 51.55\%$ .

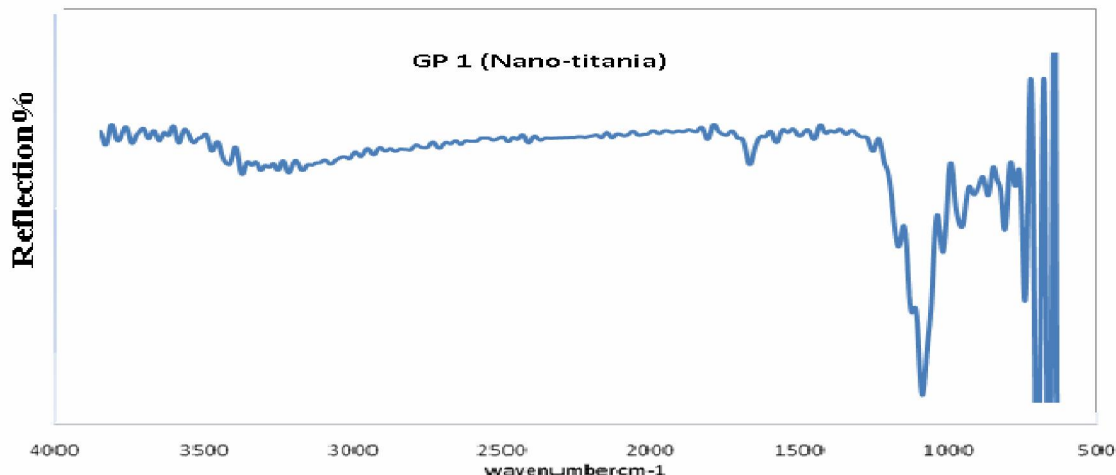


**Figure1: XRD patters of anodized Ti-alloy prior heat treatment (a) and after heat treatment (b)**

### I-2-FTIR Spectroscopic analysis:

The analysis of FTIR spectrum of anodized Ti-alloy and heat treated disks is shown in Figure (2). The spectra revealed the presence of well defined bands of  $\text{PO}_4^{3-}$  and  $\text{HPO}_4^{2-}$  groups. The bands at  $964\text{ cm}^{-1}$  and  $1069\text{ cm}^{-1}$  are characteristic for symmetric vibration of  $\text{PO}_4^{3-}$  ( $\nu_1$ ) and asymmetric stretching

vibration of  $\text{PO}_4^{3-}$  ( $\nu_3$ ) at  $1016\text{ cm}^{-1}$ . A well defined band detected at  $1140\text{ cm}^{-1}$  is characteristic for  $\text{HPO}_4^{2-}$ . The (OH) stretching bending vibration frequency of  $\text{H}_2\text{O}$  bands was detected at  $635\text{ cm}^{-1}$ ,  $1617\text{ cm}^{-1}$  and  $3564\text{ cm}^{-1}$ . The characteristic Ti-O bands were present at  $663\text{ cm}^{-1}$ ,  $836\text{ cm}^{-1}$  and  $1171\text{ cm}^{-1}$ .

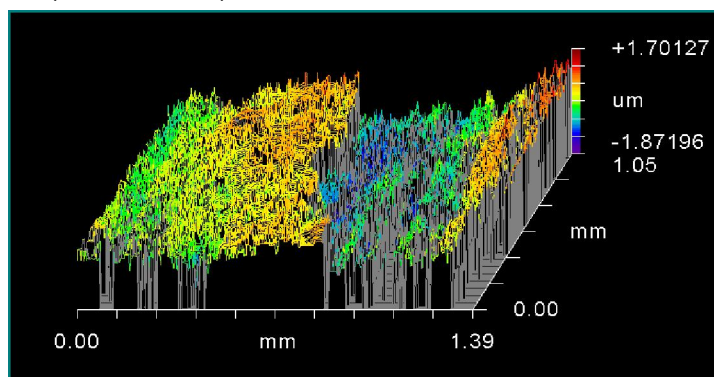


**Figure 2: FTIR spectra of anodized and heat treated disks (Group 1)**

I-3-Interference Microscopic examination (IFM):

Interference scanning micrograph of  $2500\mu\text{m}^2$  scanned area of heat treated anodized group is shown in Figure (3). The untreated surface; yellow and orange colored area, had  $R_a = 0.159\text{ }\mu\text{m}$  and  $R_p-v = 1.325\text{ }\mu\text{m}$ . Meanwhile the heat treated anodized surface; blue area, had  $0.306\text{ }\mu\text{m}$  and  $1.969\text{ }\mu\text{m}$  for

the same parameters. The average nano-tubes length at that scanned area can be calculated from  $R_p-v$  (anodized surface) -  $R_p-v$  (untreated surface). It was  $1.969 - 1.325 = 0.644\text{ }\mu\text{m}$ . The data analysis of surface topography of heat treated anodized group referred to untreated surface is tabulated in Table (3).



**Figure -3: 3D IF micrograph of nano-titania (Group 1)**

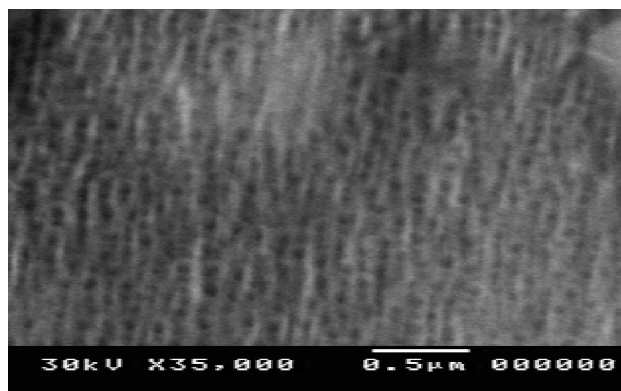
**Table 3: 3D topographic parameters of  $50\text{ }\mu\text{m} \times 50\text{ }\mu\text{m}^2$  scanning area**

Scanned area	( $R_a$ )	$R_p-v$
Untreated surface	158.9 nm (0.159 $\mu\text{m}$ )	1.325 $\mu\text{m}$
Anodized surface	306.1 nm (0.306 $\mu\text{m}$ )	1.969 $\mu\text{m}$

#### I-4- Scanning Electron Microscopic examination (SEM):

The surface morphology of both anodized and heat treated anodized Ti-alloy disks are shown in, Figure (4). The scanning electron micrograph of Ti -alloy disks were obtained at magnification X35000 that revealed the ultra microstructure of

nano-titania oxide layer. The scanned surface is characterized by the presence of multiple, discrete well defined nano-sized pores in an ordered arrangement structure on the surface. There are pores that range from 100-150 in number spread in the scanned area;  $1 \mu\text{m}^2$ , while the nano-tubes range from 45-60 nm in diameter.



**Figure-4: SE Micrographs of the prepared heat treated anodized nano-titania at magnification X35.000**

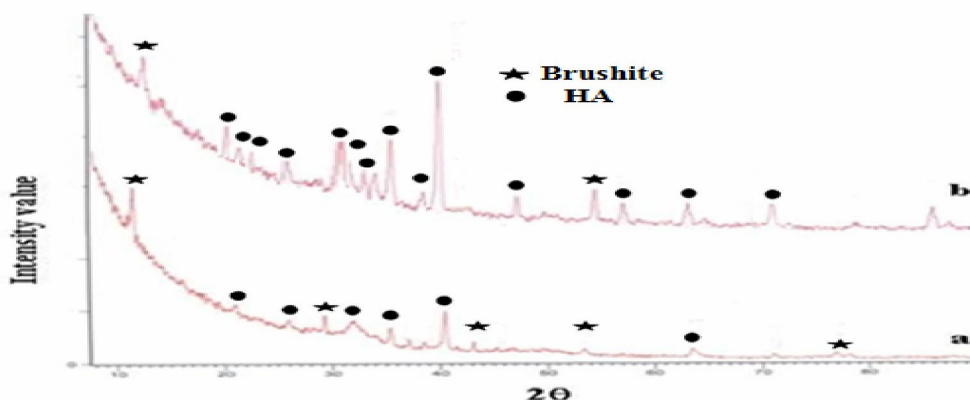
#### II- Surface characterization of electrodeposited (Group 2) and hydrothermalalkaline treated (Group 3) HA coating:

##### II- 1-X-Ray diffraction (XRD) analysis:

XRD pattern obtained for electrochemical deposited layer on Ti-alloy surface (Group 2) is shown in Figure (5-a). The data was compared with ICDD card 01-080-0410 for brushite and ICDD card 01-076-0694 for hydroxyapatite. The obtained data revealed that the coating composed of different highly crystalline calcium phosphates from; mainly brushite, and hydroxyapatite. The maximum peak intensity of 100% was found at  $2\theta = 11.64^\circ$  and  $d = 7.596$  for brushite phase. Another sharp peaks were captured at  $2\theta = 43.0872^\circ$ ,  $d = 2.099$  with  $I/I_0 = 16.77\%$  and  $2\theta = 29.1092^\circ$ ,  $d = 3.067$  with  $I/I_0 = 13.5\%$ . The

maximum peak intensity for HA was captured at  $2\theta = 40.505^\circ$ ,  $d = 40.505$  with  $I/I_0 = 82.7\%$ . Another peaks characteristics for HA were also located at  $2\theta = 31.9011^\circ$ ,  $d = 2.8$  with  $I/I_0 = 35.16\%$  and  $2\theta = 35.39^\circ$ ,  $d = 2.536$  with  $I/I_0 = 34.04\%$ .

XRD pattern of hydrothermally treated electrodeposited coating (Group 3) was shown in Figure (5-b). The data was compared with ICDD card 01-076-0694 for hydroxyapatite. The obtained data revealed that the coating was formed mainly from highly pure crystalline hydroxyapatite coating  $\text{Ca}_5(\text{PO}_4)_3\text{OH}$ , hexagonal crystal lattice. The maximum peak intensity of 100% HA was captured at  $2\theta = 31.897^\circ$ , and  $d = 2.8135$ . The other peaks were located, at  $2\theta = 32.632^\circ$ , and  $d = 2.7668$  with  $I/I_0 = 62\%$ ,  $2\theta = 35.39^\circ$ , and  $d = 2.536$  with  $I/I_0 = 3.8\%$ .



**Figure 5: XRD patterns of electrodeposited calcium phosphate (a) and alkaline hydrothermally treated HA (b)**

II-2-FTIR spectroscopic analysis of electrochemical deposited and hydrothermally treated coating:

FTIR spectra of electrodeposited coating before and after hydrothermal treatment and their spectra analyses are shown in Figure (6).

The spectrum of Group 2 revealed the presence of well defined wide bands from 568 to 1088  $\text{cm}^{-1}$  which are characteristic for  $\text{PO}_4^{3-}$  that occurs in stoichiometric composition of HA. Vibration band at 568 and 603  $\text{cm}^{-1}$  are characteristics for symmetric stretching vibration of  $\text{PO}_4^{3-}$  (4) while bands at 869, 957 and 987  $\text{cm}^{-1}$  are characteristic bands for symmetric stretching vibration of  $\text{PO}_4^{3-}$  (1). The spectral band at 1026  $\text{cm}^{-1}$  is characteristic for asymmetric stretching vibration of  $\text{PO}_4^{3-}$  (3). The vibrational band at 1060, 1088  $\text{cm}^{-1}$  is characteristic

for symmetric stretching vibration of  $\text{PO}_4^{3-}$  (3). The symmetric stretching vibrational bands of  $\text{HPO}_4^{2-}$  group are observed at 1113, 1141 and 1226  $\text{cm}^{-1}$ . The symmetric stretching vibrational bands of  $\text{CO}_3^{2-}$  are detected at 871, 1421 and 1453  $\text{cm}^{-1}$ . The absorbance bands characteristic for  $\text{H}_2\text{O}$  were observed at 624 and 3566  $\text{cm}^{-1}$  which denoting OH group of HA.

The spectral analysis of hydrothermally alkaline treated electrodeposited coating Group 3 revealed the presence of the same well defined bands of  $\text{PO}_4^{3-}$ ,  $\text{HPO}_4^{2-}$ , OH and  $\text{CO}_3^{2-}$  groups at same wave length as Group 2 but with slight shift toward the spectral inorganic region of the spectrum. The analysis of vibrational bands of  $\text{CO}_3^{2-}$  group revealed the absence of band at 1453  $\text{cm}^{-1}$ .

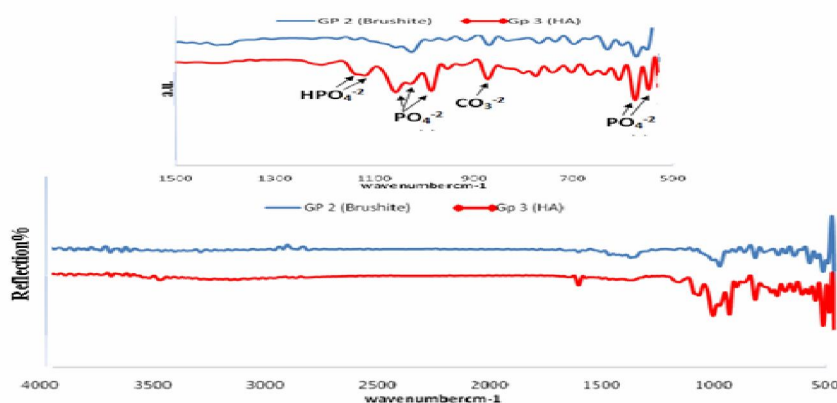


Figure (6): FTIR spectra of anodized and heat treated disks (Group 2 and 3)

II-3-SE microscopic examination:

The scanning electron micrograph of calcium phosphate electrodeposited at pH 3.6- 4 is shown in Figure (7). Thin needle like crystals arranged nearly parallel to each other forming plates having lengths ranged from 30 to 50  $\mu\text{m}$ . Elongated micro-pores of 0.5-4  $\mu\text{m}$  size are also present between the plates.

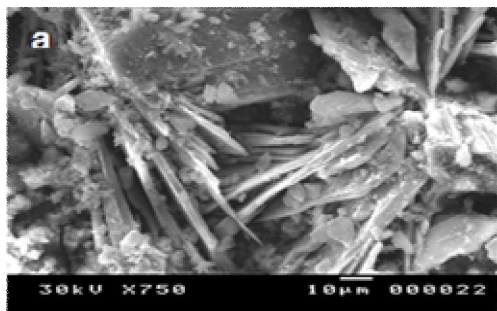


Figure (7): SE micrographs of electrodeposited calcium phosphate coating X750

The scanning electron micrograph of hydrothermally treated electrodeposited calcium phosphate coating is shown in Figure (8) that revealed densely packed needle-like crystals. The more refined structure formed of much smaller size plates indicated typical hydroxyapatite structure of nano-sized diameter. Tiny porous ultra-structure is sited as background matrix on which the crystals were precipitated.



Figure (8): SE micrographs of electrodeposited calcium phosphate coating after hydrothermal treated X5000



#### 4. Discussion:

Anodization is a controllable, reproducible and simple process to form nano-ordered tube  $\text{TiO}_2$ , Yang *et al* 2004. The fabrication of titania nano-tubes arrays via anodic oxidation of titanium in a fluoride-based solution consisted of HF and  $\text{H}_3\text{PO}_4$  were reported by Habazaki *et al*, 2007.

##### 1-Mechanism of nano-tubes formation:

The mechanism of nano-tubes arrays could be explained on the light of two processes: electrochemical anodization and chemical dissolution, Xiao, *et al*, 2007. During the anodization process in the current study, it was noticed that an initial current decay occurred probably due to the formation of the compact titania film followed by raising in the current due to the dissolution of that compact film. Finally, a steady state of low current was denoting due to the formation and growth of pores where the rate of the titania film formation equals the dissolution rate.

The process can be summarized as follow: (1) oxide growth at the surface of metal occurs due to interaction of the metal with  $\text{O}^{2-}$  or  $\text{OH}^-$  ions. (2) Metal ion ( $\text{Ti}^{4+}$ ) migrates from the metal at the metal-oxide interface and eject under application of an electric field moving toward the oxide-electrolyte interface. (3) Chemical dissolution of the metal and oxide by the acidic electrolyte takes place during anodization. However, fluoride-containing electrolyte plays a key role in the formation of nano-tubes rather than nano-porous structure, Tsuchiya *et al*, 2005.

The instantaneous anodic current application led to the oxidation of Ti to  $\text{Ti}^{4+}$  ions according to the reaction:



Then, the anodic current rapidly decayed with expected formation of an oxide layer that could be related to the following hydrolysis reaction:



The released  $\text{H}^+$  ions during hydrolysis should have accumulated and  $\text{F}^-$  ions would migrate to the site of  $\text{H}^+$  for electro-neutrality while excess  $\text{F}^-$  ions could compete for the sites of  $\text{O}^{2-}$  in the oxide. When concentrations of these ions reach a critical level at local regions, dissolution of  $\text{TiO}_2$  would have occurred by fluorotitanic acid by the following reaction:



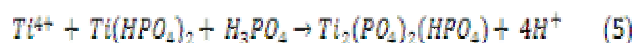
Dissolution of Ti cations would create negatively charged cation vacancies in the oxide and would migrate to the metal/oxide interface because of potential gradient across the oxide layer. The presence of metal cation vacancies near the

oxide/electrolyte interface would facilitate the reaction (1) and  $\text{Ti}^{4+}$  could easily jump to the available vacancy sites. This event was manifested by the rise in anodic current. During this stage of anodization nano-ordered pores were nucleated on the oxide surface. A steady growth state of nano-tubular oxide layer would occur as shown in schematic illustration,

The voltage of anodization is an effective factor on the formation of the titania nano-tube arrays. Nano-tube samples prepared for 45min. at 20V anodization voltage resulted in uniform ordered nanotubes arrays grown on the top of Ti-metal substrate of 200-400 nm lengths. At low anodizing voltage, the morphology of porous film is sponge-like, with a typical pore size of 15-30nm. On contrast, an increased voltage would result in a surface of particulate nature. Further increasing of voltage would lead to the loss of that particulate appearance with discrete, hollow and cylindrical tube-like features ( Ghicov *et al*, 2005) .

On the other hand, Habazaki *et al*, 2006 specified that adding  $\text{H}_3\text{PO}_4$  to HF electrolyte resulted in nano-granules, dot like structure. In this study, the use of 1M  $\text{H}_3\text{PO}_4$  with 1wt% HF electrolyte formed nano-tubes. The creation of nano-tubes could be explained by delaying the accelerated dissolution effect of  $\text{F}^-$  ions by competition with  $\text{PO}_4^{3-}$  ions resulting in localized dissolution of the oxide layer (Mor *et al*, 2006).

The dissolved titanium cations can react with phosphoric acid and form phosphates as given in reactions (4) and (5). These products could precipitate and form inner wall layers in the nano-porous structure.



FTIR spectral analysis of the anodized samples confirmed the presence of phosphorous species ( $\text{PO}_4^{3-}$  and  $\text{HPO}_4^{2-}$ ). The presence of phosphate ions could facilitate the nucleation of calcium phosphate nano-crystals within nano-tubes. Growth of HA inside the nano-tubes would give anchoring effect to electrodeposited HA nanocrystals that would enhance the interfacial bond strength between  $\text{TiO}_2$  and HA coating, Kar, *et al*, 2006.

The X-ray diffraction pattern of anodized Ti-alloy revealed the presence of many titanium oxides phases including  $\text{Ti}_6\text{O}$ ,  $\text{Ti}_2\text{O}_3$  and  $\text{TiO}_2$  (anatase) with areas of amorphous titanium oxide. The distribution of the total % area of these crystalline titanium oxides was 409.58, 28.07 and 1.3 respectively. Heat treatment (500°C/ 3hrs) result in alteration in the

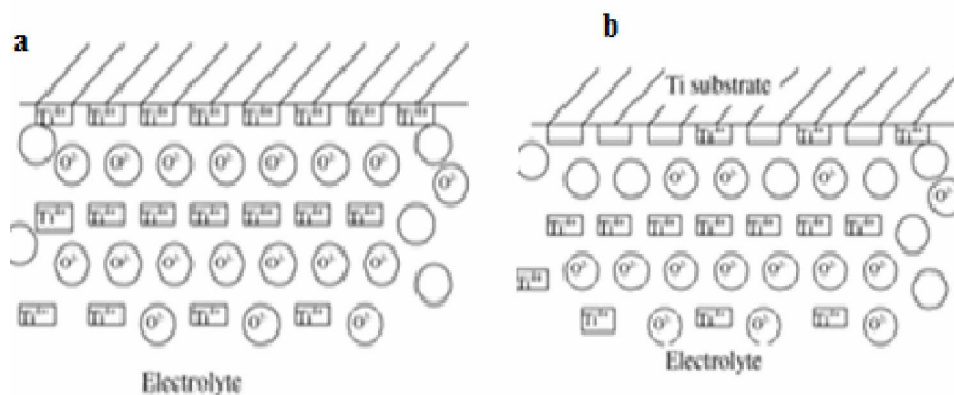


distribution of crystals as revealed by great increase in percent of  $\text{TiO}_2$  (anatase) to about 52 on the expense of other crystals, *Nian et al, 2006*. This can be attributed to the probable presence of high defect density (ion vacancies), which promotes metal ion dissolution, allowing thermal diffusion of ions and formation of more  $\text{TiO}_2$  (anatase phase) and phase transformation of the amorphous into crystalline phase, *Varghese, et al, 2003*.

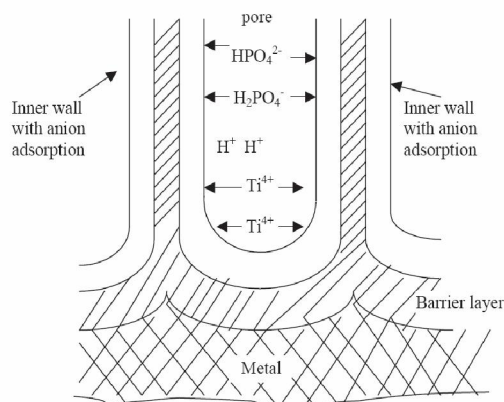
. XRD patterns in this study revealed crystal size of anatase phase ranged from 20-40 nm. The anatase phase is known to be much more beneficial for bone growth than the other phases as rutile phase

of  $\text{TiO}_2$  presumably because of the better lattice match with HA and smaller crystal size, *Ma et al, 2005*. Moreover, anatase phase has the highest chemisorptions capacity due to its higher surface energy, rough surface, and unsaturated oxygen bond, *Xie and Gao, 2009*.

The calculated lengths of nanotubes were about 644 nm as revealed by the IFM in agreement with *Khan, et al, 2006*. However, the SE Micrographs exhibited a wide range of the length of nanotubes that ranged from 800-1800 nm and their diameter ranged from 45-60 nm.



**Figure (9): A schematic illustration the mechanism of nanotubes formation (a) A stable oxide indicating  $\text{Ti}^{4+}$  and oxygen lattice positions. Oxygen vacancies are also present; (b) Cation vacancies are transported to the metal/oxide interface**



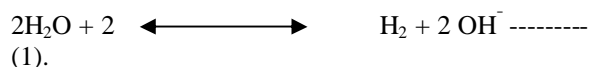
**Figure (10): Cross-sectional view of the nanotubes of anodic titanium oxide layer. The outer wall of the tube (hatched portion) does not contain anions and is more of barrier-type pure oxide material. The inner wall contains adsorbed anions from the anodization solution, phosphate ions. The adsorbed phosphate ions and  $\text{Ti}(\text{OH})_n\text{-xXx}$  phase help the nucleation of calcium phosphate crystals inside the nanopores and subsequent vertical outgrowth.**

2-Electrochemical deposition of nano-hydroxyapatite crystals:

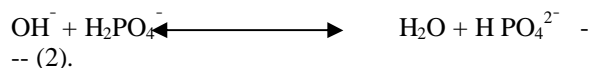
When the nanotubes were cathodically polarized in a modified simulating body fluid solution containing calcium and phosphate ions, hydroxyl ions were generated on the anodized surface. *Raja et al, 2005* suggested that hydroxyl ions would be capable to transform monovalent acid phosphates into  $(\text{PO}_4)^{3-}$  ions. The calcium ions would then electrostatically be attracted towards the cathodically polarized nanotubes to complete the hydroxyl apatite formation reaction. Thus, the HA crystals nucleate preferentially inside the nanotubes. The nucleation could be attributed to two reasons which are (1) the presence of phosphate ions on the inner walls of nanotubes and (2) relatively higher pH inside the nanotubes because of hydrothermal alkaline treatment of NaOH.

It was worthy to add  $\text{MgCl}_2$  suggested by *Wang et al, 2003* and *Yang et al, 2004* to act as nucleating agent enhancing smaller size HA crystallization on Ti-alloy surface. Moreover, modifying Ti-6Al%-4V% implant surface either by Zn, Mg or carbonated hydroxy-apatite is reported to modulate osteoblastic cell responses, *Krause et al, 2000*.

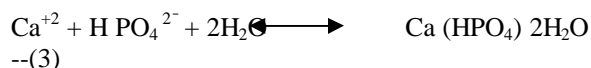
Based on theoretical chemical bases, the synthetic sequence used to produce bioceramic coatings on metallic implant surfaces is a combination of electrochemical reaction, acid-base reaction and precipitation reaction. Water is firstly reduced at the cathode surface i.e. at the surface of the implant to produce hydrogen gas and hydroxide ions, as shown in the following:



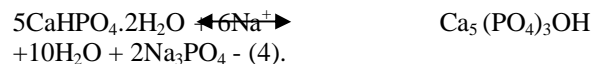
The hydroxide ions generated at the surface then may react with di-hydrogen phosphate according to equilibrium shown below:



A probable stoichiometric precipitation of mono-calcium phase ( $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$ ); brushite, might occur:



In this study, the electric current density 0.1mA and pH 4.3 controlled the deposition rate and the morphology of synthetic intermediary brushite ( $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$ ). Then, alkaline hydrothermal treatment raised pH up to 7 that would allow transformation of brushite to highly pure HA crystals according to the following equation; *Shoeib, 2004*.



XRD pattern confirmed the chemical deposition of phosphate precursor; brushite ( $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$ ), and the presence of HA crystals. As well, the transformation of brushite to hydroxy-apatite after alkaline hydrothermal treatment with increased percentage of HA; Figure (5a and b).

FTIR analysis defined the presence of HA crystals before and after alkaline hydrothermal treatment as indicated by the presence of vibrational bands 865, 872, 960, 980, 1020, 1055, 1096, 1116, 1145, 1225, and  $1415\text{cm}^{-1}$ . These bands assigned for  $\text{PO}_4$  and  $\text{CO}_3$  groups in stoichiometric composition of mature HA Figure (6). While absence of some peaks from FTIR spectrum of prior to hydrothermal alkaline treatment proposed the nonstoichiometric composition of HA Figure (6), *Gadaleta et al, 1996*.

Thin needle like crystals arranged nearly parallel to each other forming plates having lengths ranged from and 50 to 80 nm diameter. The elongated micro-pores of size of 0.5-4  $\mu\text{m}$  present between needle like plates of microscale (30-50  $\mu\text{m}$ ) shown in SE micrograph Figure (7) might have resulted from the generation of hydrogen bubbles produced due to cathodic reaction during electrochemical precipitation, *Nishio et al, 2000*. Meanwhile, the application of high pressure during alkaline hydrothermal treatment refined the crystals giving rise to thin needle like structure that identifying typical HA crystals in nanoscale size; Figure(8), this come in agreement with *Shoeib 2004*.

## 5. Conclusions:

- 1- A novel anodization technique was employed to create ordered nano-titania arrays on the surface of Ti-6Al%-4V% alloy.
- 2- Immersion in solution containing  $\text{H}_3\text{PO}_4$  and HF during anodization produced nuclei for HA growth.
- 3- Heat treatment of anodized Ti-alloy surface transformed the surface oxide to the beneficial anatase phase of  $\text{TiO}_2$ .
- 4- Nano-titania tubes promoted the electrodeposition of highly nano-crystalline bioactive HA coating.

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## Kinetics of Dissolution of COM Crystals in the Presence of some Organic Solvents

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**Abstract:** Dissolution rates of calcium oxalate monohydrate crystals were studied in absence and presence of propionic acid (PA), acetone, dimethyl-sulfoxide (DMSO), iso propanol (IPA) and dimethyl-formamide (DMF). It was found at the experimental conditions of PH : 6.5,  $t = 37^{\circ}\text{C}$ ,  $I = 0.15 \text{ mol dm}^{-3}$  and  $\sigma = 0.09$ , the dissolution followed surface controlled mechanism. The order of inhibition of additives on the rates of dissolution of COM crystals at experimental conditions was:  $\text{PA} > \text{acetone} > \text{DMSO} > \text{IPA} > \text{DMF}$ . The effects of change of  $I$ , pH,  $\sigma$  and Temperature on the rates of dissolution of COM crystals in the presence of,  $10^{-7} \text{ mol dm}^{-3}$  were studied. [N.S. yehia, F.A. Essa and M.G. Abbas. **Kinetics of Dissolution of COM Crystals in the Presence of some Organic Solvents.** Journal of American Science 2011;7(4):585-591]. (ISSN: 1545-1003).  
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**Keywords:** Kinetics of Dissolution; Crystal; Organic Solvent

### 1. Introduction:

Stone formation in renal systems is one of the oldest and the most common form of crystal deposition disease. Analytical results show calcium oxalate ( $\text{CaC}_2\text{O}_4$ ) to be one of the major inorganic components of renal stones and is found to be present in almost all kidney and bladder stones. About 39.4% of the total composition of the calculi is found to contain purely calcium oxalate and also it occurs along with calcium phosphates and apatites <sup>(1)</sup>.

Calcium oxalate is one of the main constituents of deposits in urinary tract. Crystallization of calcium oxalate is of particular interest not only from the theoretical point of view but also because of its biological importance. The exact mechanism of the initiation of the calcium oxalate stone formation is not completely understood. Factors leading to the nucleation, crystal growth and aggregation of various hydrates of calcium oxalate depend not only on the excess of calcium and oxalate concentration but also on the presence of various foreign substances <sup>(2)</sup>.

One of the challenges for applied crystal science in the last decade has been the development of processing methodologies which secure the production of good quality crystals that are free from impurities. The fact that solvents may be active in modifying the growth form or phase of a crystal has been recognized and accommodated in production. Equally successful has been the development of additives capable of tailoring the specific growth form of crystal to optimize function through control of habit and morphology <sup>(3)</sup>.

Stone formation is related to the balance between supersaturation and inhibitors existing in urine. An important part of the study of urinary stone

formation is to develop an understanding of interactions between the stone crystals and the components of organic matrix. The effect of pH, foreign ions, organic solvents and the degree of supersaturation in aqueous systems have been extensively studied. Few investigations have been made to the study of the effect of solvent.

In the present study the effects of PA, acetone, DMSO, IPA and DMF on the dissolution mechanism of dissolution COM crystals at conditions similar to that of human body were studied.

### 2. Experimental:

#### Preparation of solutions:

Pyrex glass ware and analytical grade chemicals were used throughout, water was purified by deionization followed by triple distillation. It was stored in a pyrex vessel under nitrogen. Solutions of calcium chloride, sodium oxalate were made from analytical grade reagents (EL.Nasr pharmaceutical chemicals company fisher scientific company and baker chemical company) weighed amounts of the salts were dissolved in a volume of deionized distilled water. Those solutions were then filtered through prewashed millipore filter pads (0.22m, Millipore filters), quantitatively transferred to grade volumetric flasks and diluted to the required volume with deionized distilled water. Those solutions were analyzed by passing aliquots through a cation exchange resin (Dewix-50) in the hydrogen form and titrating the eluted acids with standardized sodium hydroxide solutions of suitable concentration using phenolphthalein as indicator.

#### Preparation of seed:



Calcium oxalate seed was prepared by adding one liter of (0.1 M) calcium chloride solutions to one liter of sodium oxalate solution (0.1M) at 298°K at a rate of 250 ml per half an hour. The calcium oxalate solution was constantly stirred for one day and was then filtered and the seed crystals were washed with deionized distilled water to remove surface contamination due to chloride and oxalate ions. The seed crystals were aged for one month, then were refiltered and washed further with deionized distilled water and this process was repeated several times. The seed was then filtered and dried. The seed material was then subject to x-ray powder diffraction studies, scanning electron microscope and the determination of specific surface area (SSA), IR and TGA analysis.

#### Measurements of surface area:

The surface area was calculated adopting the value of  $A^\circ$  for cross-section of krypton SSA value was  $3.73 \text{ m}^2\text{g}^{-1}$ .

#### Preparation of Inhibitors:

Solutions of Dimethyl formamide (DMF), Dimethyl sulfoxide (DMSO), Acetone, Isopropyl alcohol (IPA), Propionic acid (PA) were prepared by taking suitable volume of the liquids then completed by deionized distilled water to suitable volume. The desired concentrations were prepared by dilution the solution of: DMF (Adwic Company), Acetone (Adwic Company), DMSO (Fluka AG, chem...Fabrik CH-9470 Buchs), Isopropyl alcohol (Adwic company), Propionic acid (Laboratory Rasayan).

#### Potentiometric measurements:

pH measurements were made with a combined pH glass electrode (model 9100 metrohm AG company) Emf measurements were made by calcium ion selective electrode (U4-9101 Herisau), in conjugation with a Calomel reference electrode (model 90.02 orion Research incorporated laboratory products group). The electrodes were checked before and after each dissolution experiment using the buffer solutions recommended, by Bates. pH glass electrode and using calcium chloride solutions with definite concentrations in case of calcium selective electrode. If combined pH glass electrode measurements differed from the required, the electrode was reconditioned in warm HCL solution in case of calcium ion selective electrode, if the measurements were differed from the required, the electrode was put in solution of  $10^{-2}\text{M}$   $\text{CaCl}_2$  for few days.

In dissolution experiments-using potentiostat, the studies were made at constant Emf. Metrohm combititrator: consisted of dosimate model 665. Impulsomate model 614, pH-mater model-632 stirrer

model E649, was used to control the addition of titrant solution consisting of 0.15 M sodium, chloride, into the reaction vessel since the impulsomate provides proportional system was able to respond to a change of Emf of  $< 0.002 \text{ mv}$  on the addition of reagents.

#### Dissolution Experiments:

The crystal dissolution experiments were carried out in water thermostated double-walled pyrex glass vessels. The cells were maintained at the required temperature ( $37^\circ\text{C}$ ) by circulating thermostated water through the outer jackets. The cell contents were stirred with a magnetic stirrer (and pre-saturated nitrogen gas bubbled through the solutions during the experiments to exclude carbon dioxide).

In dissolution experiments, a measured volume of de-ionized distilled water was transferred to the cell and a known volume of sodium chloride was added, then definite volume of calcium chloride solution was added followed by slow addition of known volume of sodium oxalate solution over a period of five minutes. The total volume was usually 300 ml and the pH was adjusted to the required value ( $6 \pm 0.05$ ) using standard sodium hydroxide solution or/and standard hydrochloric acid solution. Satisfactory stability of the undersaturated solution was verified by constant pH reading for at least 30 minutes in experiments using pH-state, and by stability of Emf reading also at 30 minutes in potentiostat experiments. Following the addition of dry seed crystals, dissolution began immediately and combined pH glass electrode was used to controlling the addition of titrant solution consisting of 0.15 M sodium chloride in experiments using pH-state, while calcium ion selective electrode in conjugation with calomel reference electrode were used in experiments using potentiostat.

In addition, samples were periodically withdrawn and filtered at the reaction temperature through Millipore filters (0.22  $\mu\text{m}$ ), prior to solution and solid-phase analysis.

#### 3. Result and Discussion:

The kinetics of growth and dissolution of the hydrates and transformations between them allow industrial processes to be modeled. On the other hand, CaOx is the major constituent of kidney stones in the western hemisphere. Thermodynamic (supersaturation) and kinetic (nucleation, growth and aggregation) factors play a role in the pathogenesis of this disease. While CaOx dihydrate (COD) crystals occur in urine, the monohydrate (COM) is much more common in stones<sup>(4)</sup>.

In the present work, dissolution rates of calcium oxalate monohydrate(COM) crystals were

studied in the absence and the presence of some organic solvents.

In the present work, the rates of dissolution of COM ( $K_{so} = 9.899 \times 10^{-8}$ ) have been investigated at 37°C in absence and presence of trace amounts of natural products from medicinal plants in undersaturated solution. For many sparingly soluble sates  $M_aA_b$ , the rate of dissolution normalized for seed surface area, can be expressed by the equation :

$$R = d[M_aA_b]/dt = KS\sigma^n \quad (1)$$

Where:

K = is the dissolution rate constant

S = is proportional to the number of dissolution sites available on the seed crystals.

n = is the effective order of reaction

$\sigma$  = is the relative degree of under saturation.

The degree of relative under saturation,  $\sigma$ , may be expressed by the equation.

$$\sigma = \left[ \pi_0^{\frac{1}{2}} - \pi^{\frac{1}{2}} \right] / \pi_0^{\frac{1}{2}} \quad (2)$$

where:

$\pi$  : is the motor concentration product of calcium oxalate in the solution.

$\pi_0$  : is the solubility value at the same ionic strength (0.15 mol dm<sup>-3</sup> in the present work).

The relative under saturation  $\sigma$ , for a solution containing equal calcium and oxalate ions (present work) can be defined :

$$\sigma = \left( [Ca^{2+}]_t - [Ca^{2+}]_{eq} \right) / [Ca^{2+}]_{eq} \quad (3)$$

The subscripts "t" and "eq" are values at time "t" and at equilibrium respectively.

In non-stoichiometric concentration of calcium and oxalate ion :

$$\sigma_t = \left( [Ca^{2+}]_t [C_2O_4^{2-}]_t \right)^{\frac{1}{2}} - \left( [Ca^{2+}]_{eq} [C_2O_4^{2-}]_{eq} \right)^{\frac{1}{2}} \quad (4)$$

the thermodynamic solubility product :

$$K_{sp} = [Ca^{2+}] [C_2O_4^{2-}] f_z^2 \quad (5)$$

Where :

$f_z$  : is the activity coefficient of divalent ion

The activity coefficients of divalent cation and anion were assumed to be equal and were obtained using the extended Debye Huckel equation proposed by Davis<sup>(5)</sup>.

$$-\log f_z = AZ^2 \left[ \frac{\sqrt{I}}{1 + \sqrt{I}} - 0.31 \right] \quad (6)$$

Where:

Z : is the charge on the ion (valence).

I : Is the molar ionic strength and

A : is constant

In order to be able to analyse the kinetics of dissolution reactions in terms of concentrations of free ionic species, it is necessary to take into account ion- pair and complex formation, also some computations were made, as described previously.<sup>(5-6)</sup>

Nucleus in dissolution process is a microscopic hole in the crystal surface whereas, in growth process a nucleus is small hill of material stacked on the crystal surface.

COM crystals are prepared, X-ray, IR, Scanning electron microscope, TGA and S.S.A analysis confirm the COM crystal structure. The effect of change temperature, concentrations, weights of seed crystal used to initiate the dissolution process, rate of stirring and ionic strengths on the rate of dissolution of COM were studied.

The effect of degree of under-saturation ( $\sigma = 0.04 - 0.15$ ) on the rate of dissolution of COM crystals were studied table (1), Fig (1)

**Table (1): Dissolution of calcium oxalate crystals  $T_{ca+2} : T_{ox-2} = 1:1$  at  $t = 37^\circ \text{C}$  and ionic strength 0.15 mol dm<sup>-3</sup> (NaCl) using E.M.F.**

ExpNo.	$TCa^{+2}/10^{-4}$	$10^2 \sigma$	Seed/mg	Rate/ $10^{-9}$ mol min <sup>-1</sup> m <sup>2</sup>
10	1.914	4	10	2.250469831
11	1.894	5	10	3.310876924
12	1.854	7	10	5.903879458
13	1.814	9	10	8.740460458
14	1.794	10	10	10.68246937
15	1.774	11	10	12.314689480
16	1.735	13	10	16.51267932
17	1.695	15	10	20.20896798
18	1.814	9	50	8.750143820
19	1.814	9	90	8.735216841
20	1.814	9	300	8.7209632
21	1.814	9	500	8.71502463
22	1.814	9	700	8.71094632
23	1.814 <sup>a</sup>	9	10	8.740460458
24	1.814 <sup>b</sup>	9	10	8.75143215

a) String rate (200) r.p.m    b) String rate (500) r.p.m

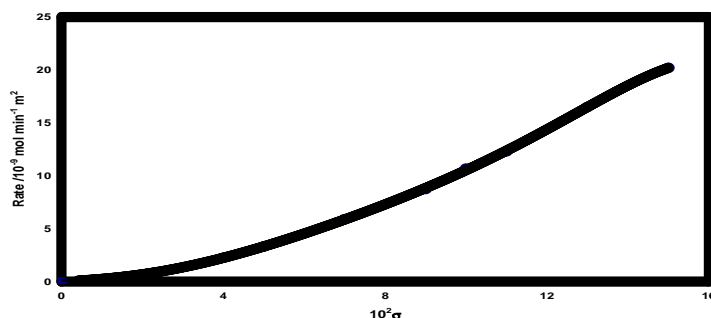


Fig. (1): Plots of rate of dissolution against degree of undersaturation, using EMF.

The effective order of dissolution process of COM crystals was found 2 which suggest surface controlled mechanism. The effect of change of

temperature on the rates of dissolution of COM were studied Fig(2).

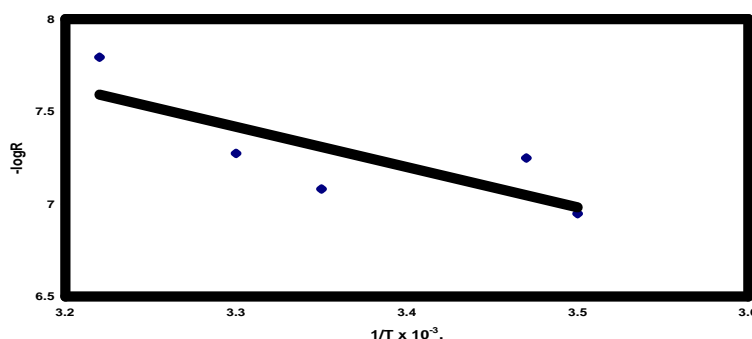


Fig. (2): Plots of  $-\log R$  against  $1/T$  for dissolution of calcium oxalate monohydrate crystals  $\sigma = 0.09$ , using EMF.

The activation energy was found equal to 5 K. cal which support surface- controlled mechanism. Also the stirring dynamics didn't affect on the dissolution rates of COM crystals. The effect of change of pH of medium on the rates of dissolution was studied. From the study, increasing the pH of medium lead to decrease the dissolution rates of COM crystals.

The effect of change of ionic strength on the rate of dissolution of COM crystals was studied. From the study increasing ionic strength of medium leading to increase the dissolution rates of COM crystals at experimental conditions.

Additives of both an organic and inorganic nature play an important role in crystallization processes. It is important to know how the additives influence the crystallization process. The type of polar functional groups contained in additives, the number of polar functional groups contained per molecule, hydrophobic and hydrophilic regions, the molecular weight and concentration of additives and a close match between the spacing of acid groups and the spacing of cations of the crystal surface are considered factors that influence crystallization it is proposed that the additives have two functions:

- They could inhibit crystal growth by binding to the growth sites of the crystals.
- They could act as a heterogeneous nucleator.

The dissolution of COM crystals in the presence of dimethyl formamide, DMF, dimethyl sulfoxide (DMSO), acetone, isopropanol (IPA) and propionic acid (PA). the order of inhibition of dissolution rates of COM crystals was found: PA > acetone > DMSO > IPA > DMF

It was found that concentrations as low as  $10^{-6}$  mol dm $^{-3}$ , markedly reduced, the dissolution rates by factors at least 98, 95, 89, 86 and 55 times compared to that in the absence of additives at the same relative under-saturation ( $\sigma = 0.09$ ) which suggest the order of inhibition of the additives: PA > acetone > DMSO > IPA > DMF

The low concentrations of inhibitors that could inhibit the dissolution or crystallization processes indicates that these inhibitors are effective and that low surface coverage indicates the rate determining step. When the concentration of additives molecules increase, the rates of dissolution decrease due to blocking of the active sites on the crystal surfaces by the additives:

When the concentrations of the additive molecules increase, the rates of dissolution decrease due to blocking of the active sites on the crystal surfaces by the additives. Cations may be adsorbed at anionic sites and inhibit the dissolution when present at very low levels and vice versa<sup>(7)</sup>.

Adsorption growth factor depends strongly on the nature of the substrate, adsorption sites. The amount of bound growth factor increased almost linearly with its concentration in the solution. It is generally assumed that, the proteins are mainly adsorbed through electrostatic attraction between hydroxyl apatite (HA) surface and anionic groups. The adsorption studies indicated that compounds with the same structure may react quite differently, depending on the surface characteristics. In some extent, the difference of adsorption capabilities of the additives are very effective factors.<sup>(8)</sup>

Natural materials contain impurities which are released by dissolution disintegration of the mineral. There are two possibilities existing

- The impurities are released into the solution, from which they are adsorbed reversibly to the surface of the mineral, acting there as inhibitors.
- They are adsorbed irreversibly at the surface either directly from the disintegrating mineral, or they are the first released solution from which they are adsorbed to the surface.

In case (a), the surface concentration is related to the impurity concentration in the solution by an adsorption isotherm. But in case(b) it was assumed, complete irreversible binding of released impurities to the mineral surface so the impurity concentration become zero. If reversible adsorption of inhibitors is operative, then surface adsorbed inhibitors should be released to the solution and their surface concentration should be reduced significantly. If re-adsorption of the impurities would occur, the surface concentration of adsorbed inhibitors should be higher in the mineral than that of the solution. Studies indicated:

- Adsorption of the inhibitors to the mineral surface is irreversible.
- Inhibition are not captured from the solution.

The surface controlled dissolution kinetics of natural calcium oxalate minerals depend on the experimental conditions employed to obtain them. The surface concentration of the inhibitors depends on the thickness of the oxalate layer removed by dissolution and on their concentration in the bulk solid. Therefore, the inhibition raises strongly with the thickness of the removed layer ( $d$ ), until sufficiently large ( $d$ ), remains constant. Inhibitors are not adsorbed from solution<sup>(9)</sup>.

Recently, it was reported that the mechanism of the interaction of calcium oxalate with an organic molecule depend on the size, ionic charge and structure of additive molecules.<sup>(10 - 11)</sup> Small molecules with high charge density preferentially interact electrostatically with charged lateral faces and high energy tips of growing crystals.

So in the present work the additive molecules are adsorbed on the active  $\text{Ca}^{2+}$  ion sites. This can be interpreted in terms of Langmuir – type isotherm between  $R_0 / R_0 - R_i$  against  $[\text{additive}]^{-1}$  must be linear. Values of  $(R_0 - R_i / R_0)$  and  $[\text{additive}]^{-1}$  of dissolution of COM crystals at relative undersaturation,  $\sigma = 0.09$ , are listed in table (2). Fig.(3) Confirms the applicability of this simple adsorption isotherm at the same relative undersaturation,  $\sigma = 0.09$ , which reflects the adsorption of these additives at the active  $\text{Ca}^{2+}$  ion sites. Most of these solvents in the present work are ionized so they are adsorbed electrostatically (since the dissolution rates depends on the ionic strength of the medium) to the surface of COM. The value of affinity constants,  $K_L$ , (given by inverse slopes of the lines in fig.(3) are 6.34, 3.42, 1.16, 1.07 and 0.33  $\times 10^7 \text{ dm}^3 \text{ mol}^{-1}$  for PA, acetone, DMSO, IPA and DMF respectively. These values of  $K_L$  reflect the high adsorption affinity at the same relative undersaturation  $\sigma = 0.1$  which runs in the order: PA > Acetone > DMSO > IPA > DMF.

Table (2): Effect of  $R_0/(R_0-R_i)$  against  $[\text{Additive}]^{-1}$  of dissolution of COM in presence of propanoic acid, acetone, DMSO, isopropanol and DMF.

$10^6 [\text{Additive}]^{-1}$	$(R_0 - R_i) / R_0$				
	Propanoic acid	Acetone	DMSO	Isopropanol	DMF
1	1.020	1.045	1.120	1.15	1.801
2	1.050	1.121	1.210	1.24	2.203
5	1.099	1.150	1.501	1.55	2.550
10	1.215	1.343	1.845	1.98	4.305
15	1.301	1.501	2.250	2.45	5.750
20	1.396	1.690	2.650	2.84	7.050
25	1.504	1.880	3.100	3.35	9.010
30	1.605	2.05	3.549	3.81	10.65
40	1.804	2.410	4.400	4.75	11.99
50	1.780	2.775	5.101	5.81	14.599

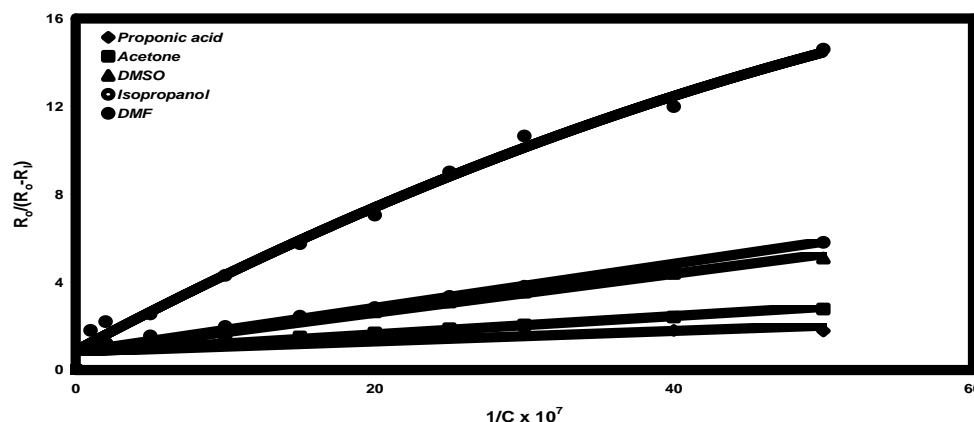


Fig. (3): Plot of  $R_o/(R_o-R_i)$  against  $[Additive]^{-1}$  of dissolution of COM in presence of propanoic acid, acetone, DMSO, isopropanol and DMF.

The effects of changing pH, temperature,  $\sigma$  and  $I$  of the medium on the inhibitory effect of DMSO on the rate of dissolution of COM were studied.

Based on the assumption that the degree of inhibition may be affected by the degree of relative undersaturation, the dissolution of COM crystals in the presence of  $10^{-7}$  mol  $\text{dm}^{-3}$  DMSO has been investigated at different  $\sigma$  values ( $\sigma = 0.09 - 0.25$ ).

It was found that the change in pH of the medium in the presence of  $10^{-7}$  mol  $\text{dm}^{-3}$  didn't affect the rates of dissolution of COM crystals at experimental conditions of ( $\sigma = 0.09$ ,  $t = 37^\circ\text{C}$ ,  $\text{pH} = 6.5$ ).

The effect of change of ionic strength on the rates of dissolution of COM crystals in the presence of  $10^{-7}$  mol  $\text{dm}^{-3}$  at the same experimental conditions was studied. It was found that increasing ionic strength of the medium leads to increasing the rate of

dissolution of COM crystals i.e decrease the degree of inhibition of DMSO. The changing of rates of dissolution of COM in crystals with changing ionic strength of the medium indicates that the inhibition is electrically in its nature.

The effect of change of  $\sigma$  on the rates of dissolution of COM the presence of  $10^{-7}$  mol  $\text{dm}^{-3}$  was studied. The order of dissolution of COM crystals in the presence of  $10^{-7}$  mol  $\text{dm}^{-3}$  was found = 2 which indicates surface controlled mechanism fig. (4)

The effects of change of temperature on the rate of dissolution of COM crystals in the presence of  $10^{-7}$  mol  $\text{dm}^{-3}$  were studied. Fig(5).

The activation energy was found equal to 2.5 k. cal rule out the surface controlled mechanism.

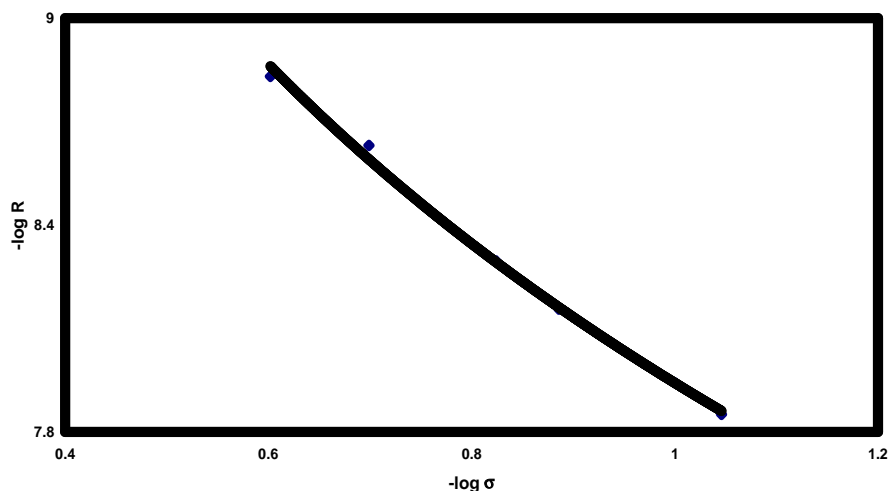


Fig. (4): Effect of change  $\sigma$  in the presence of  $10^{-7}$  M (DMSO) at  $37^\circ\text{C}$ .



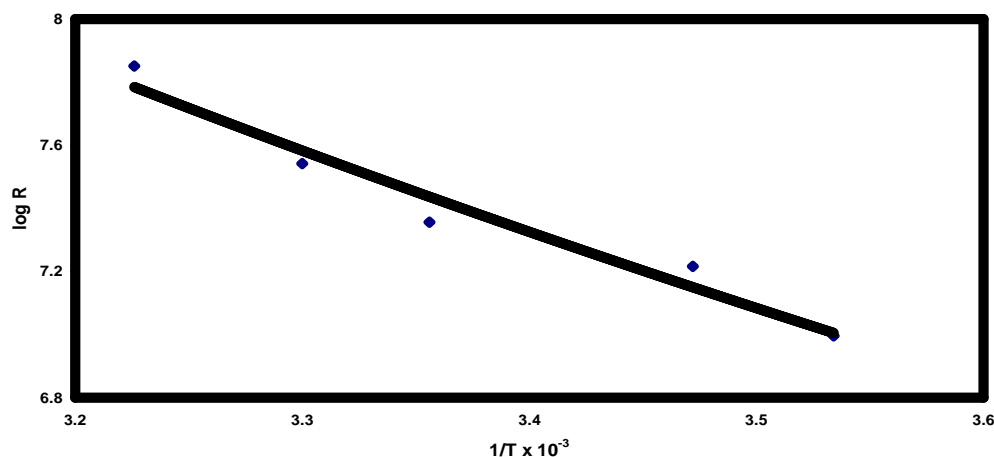


Fig. (5): Effect of temperature on the rate of dissolution COM in the presence of  $10^{-7}$  M DMSO,  $\sigma = 0.09$  at EMF

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## Risk Factors of Protein Energy Malnutrition "Kwashiorkor and Marasmus" among Children Under Five Years of Age in Assiut University Children Hospital

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**Abstract:** The aim of the study is to identify the risk factors of protein energy malnutrition among children under five years of age in Assiut university children hospital. A correlation descriptive research design was chosen for this study. A convenient sampling design was followed to include children suffering from protein energy malnutrition aged below 5 years. Control group was purposively selected to be nearly age and sex matched. A total of 150 study and 150 control were included. The results revealed that PEM was more found in children in families of middle and low socioeconomic status with statistically significant differences, history of malnutrition in other sibling and younger age than others, statistically significant differences between practices of mothers in the cases than the control groups were found regarding breast feeding, artificial feeding and additional and adult food with low level of satisfactory practices observed among mothers in the cases than those in the control groups. From this study it can be concluded that several risk factors were found to be associated with PEM including, lower education level of the mother, number of children in the family as the number of children in the family decreased, the prevalence of PEM increased, low and middle family socioeconomic status, age of the child, children with the younger age are more vulnerable to have PEM than those of older age and mothers' practices regarding feeding of their children (breast feeding, artificial feeding as well as additional and adult food) unsatisfactory practices of mothers regarding feeding of their children increase the prevalence of PEM among their children. This study recommended that Supporting and promotion of breast feeding, avoid using of artificial feeding and bottles, health education to the mothers about proper feeding practices, breast feeding, artificial feeding and additional and adult food to prevent PEM, increasing mother's awareness related to risk factors of PEM and how to manage the different infections among their children and encourage vaccination at the appropriate time.

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<http://www.americanscience.org>.

**Keywords:** Risk Factor; Protein Energy Malnutrition; Kwashiorkor and Marasmus; Children; Assiut University Children Hospital

### 1. Introduction:

Malnutrition is a major health problem, especially in developing countries. It affects almost 800 million people, 20% of all in the developing countries. It is associated with about half of all children death worldwide (Kumar et al., 2002).

Inadequate food intake is the most common cause of malnutrition worldwide. In developing countries, it is secondary to insufficient or inappropriate food supplies or early cessation of breastfeeding. In some areas, cultural and religious food customs may play a role. Inadequate sanitation further endangers children by increasing the risk of infectious diseases that increase nutritional losses and alters metabolic demands (Grigsby, 2005).

Social, economic, biologic, and environmental factors may be the underlying causes for the insufficient food intake or ingestion of foods with proteins of nutritional quality that lead to Protein Energy Malnutrition (PEM). Additional factors are bottle-feeding, inadequate knowledge of proper child

rearing practices and parental illiteracy. The most extreme forms of protein-energy malnutrition are Kwashiorkor and Marasmus (Wong's et al., 2007). Prevention of malnutrition in children starts with an emphasis on prenatal nutrition and good prenatal cares, health care providers should emphasis on the importance of breast feeding in the first years of life, in addition to the promotion of breast feeding, they should counsel parents on the appropriate introduction of nutritious supplemental foods. All pediatric nurses must be understand the importance of optimal nutrition for the normal healthy child, the nurse knows that in order for children of all ages to reach the goal of adequate nutrition, up- to- date advice and dietary support must by provided (Wongs et al., 2007).

### Aim of the study

The aim of the study was to identify the risk factors of protein energy malnutrition (Kwashiorkor

and Marasmus) among children less than five years of age in Assiut university children hospital.

## 2. Subject and Methods

### Research design:

A correlation descriptive research design was chosen for this study.

### Subject

A convenient sampling design was followed to include children suffering from protein energy malnutrition aged below 5 years. Control group was purposively selected to be nearly age and sex matched. A total of 150 study and 150 control were included.

### Characteristics of sample:

Study group consists of children aged less than 5 years attending to the rehydration medical and emergency unit at Assuit University Children Hospital and who were clinically diagnosed with protein energy malnutrition. Control group consists of nearly age and sex matches children who are free from diarrhea and attending to the well-baby clinic, and emergency unit Assiut University Children Hospital, those with no past history of protein energy malnutrition. Data collection of the study group was taken from mothers of infants and / or children under 5 years of age with protein energy malnutrition coming to the Assuit University Children Hospital (rehydration, medical and emergency units). Data collection of the control group was taken from mothers of infants and / or children under 5 years of age without protein-energy malnutrition coming to well-baby clinic for vaccination and emergency unit.

### Tools of the study: Three tools were used to collect the required data for the study:

Structured Interview questionnaire sheet, Anthropometric assessment sheet and Socio economic scale (Abdel Tawab, 1998).

1- The structured interview questionnaire was developed specifically to collect data related to this study from mothers of both the study and the control groups it included.

Socio-demographic data related to mothers such as mother's age, educational level, working condition, residence, family size and marital condition.

Identification data related to the child as age of the child, sex, birth order, diagnosis, type of feeding, type of milk and vaccination.

c- Mothers practices as they responded related to breast feeding, artificial feeding and additional and adult foods.

### 2- Family socioeconomic scale:

It included, social economic data of the family were assessed using method of Abed-El-Tawab, (1998) which including: The educational level of the father and mother included 8 levels (illiterate, read and write, primary, preparatory, secondary, university, post graduate and doctoral) , income of the family in month included 6 levels, social status for the family includes occupation of the father and working condition of the mother, housing condition and residence and other items including questions to identify if the family buy daily newspaper, weekly or monthly journal, if they have a library in the house, if they participate in the club for activities, and if they have (car, taxi, video cassette, computer, dish, mobile, and or fax).

### A Pilot study:

It was carried out on a group of 30 mothers and their infants or children less than 5 years, who suffering from protein energy malnutrition. Mothers and infants or children included in the pilot study were excluded from the sample. The purposes of the pilot study were to test the contents and validity of the questionnaire sheet and estimate the length of the time needed to fill the sheet. According to the results of the pilot study, the essential modifications in the sheet were done and the final form was developed.

### Data collection Procedure:

Preparation of the tools used for the study after reviewing to the appropriate literature. An official letter from the faculty of nursing, Assuit University was prepared and delivered to the director of Assuit University Children Hospital asking for permission to collect the necessary data for this study. The work was carried out by the investigator herself. Data was collected during the period from June 2006 to June 2007. The collection of data was collected two days per week for the study group, and three days per week for the control group (scheduled days for vaccination in the well baby clinic). Each mother was interviewed individually to fill the structured interview questionnaire sheet and to assess the family socioeconomic status after complete explanation of study goal. Each mother reassured that information obtained are confidential and used only for the purpose of the study. Each child was assessed for his Body weight using a standardized scale. The length or height, head, chest, and mid-arm circumferences were assessed using a measuring tape.

### 3-Data analysis

The collected data were coded and verified prior to computerized data entry. Descriptive

statistics were calculated (e.g., frequency, percentage, mean and standard deviation). A significant P-value (probability of rejecting a correct null hypothesis) was considered if less than or – 0.05.

### 3. Results

Table (1) shows the comparison between the cases and the control groups regarding to identification data of their mothers. Statistically significant differences between the two groups were found regarding educational level, number of children in family and family size with higher prevalence of illiteracy among mothers of the cases than those of the control groups (68.7% and 44%, respectively), while university education constituted among 4% and 5.3% of mothers in the two groups respectively. (40.7% and 54.7%) of the families had 1-2 children respectively, also 24.6% of families in the cases group compared with 16% of those in the control group had 5 children and more. 66.7% and 47.3% of families in the two groups respectively had more than 7 persons.

No statistically significant differences between the cases and control groups were found regarding age of the mother, working condition, residence, marital status, presents of diseases and time between the current child and the next pregnancy.

Table (2) shows the comparison between the cases and the control groups of children according to their identification data. Statistically significant differences between children in the cases and the control groups were found regarding their age and history of malnutrition in other siblings. Regarding the age of children, the study revealed that more than half of children in the cases and the control groups (52% and 60.7%, respectively) were their age ranged from 2 months < 1 year. While children aged 3-5 years were 6% and 14% in the cases and in the control groups respectively P.value (0.002), higher prevalence of children in the cases group rather than those in the control group was found in history of malnutrition in other sibling (21.3% and 2.7%, respectively). No statistically significant differences between the cases and control groups regarding children sex, birth order and incomplete vaccination, 23.4% of children their birth order was the fifth or more in the case group compared to 14.7% of those in the control group. In addition the table shows that 92% of children in the cases group had Marasmus.

Table (3) shows the comparison between the cases and the control groups of children regarding to their feeding pattern. Statistically significant differences between children in the cases and control groups were found regarding types of feeding offered since birth, types of milk, causes of artificial feeding

and method of feeding, all children in the two groups were on breast feeding (100%) while artificial feeding was constituted in 52.7% and 22.7% of children in the cases and the control groups respectively. Powder milk was prevalent in children in the two groups than other types 43% and 55.8% of them in the cases and the control group respectively. Regarding causes of artificial feeding responded by mothers of children in the cases and the control groups respectively were little amount of milk (63.3% and 26.8%) breast problem (13.9% and 20.6%) and working of the mother (7.6% and 26.8%) P.Value 0.001. The table also shows that using of bottle was more prevalent among the two groups, 59.4% and 79.4% for children in the cases and the control groups, respectively.

Table (4) shows comparison between the cases and the control groups of children regarding their mothers' practices related to artificial feeding. Statistically significant differences were found between the two groups regarding items of boiling bottle for 10 minutes (34.2% and 82.4%), boiling nipple for 3 minutes (26.6% and 79.4%), boiling water (58.2% and 88.2%), determine the correct amount of water and powder (49.4% and 82.4%), put the child in correct position (68.4% and 91.2%), eructation of the child (46.8% and 82.4%) and skip the remaining part (68.4% and 100%) for the cases and the control groups, respectively

Table (5) shows the comparison between the cases and the control groups of children regarding their mother's practices related to additional food (weaning) and adult food. Statistically significant differences were found between the two groups related items of time of starting the additional food and item of elements of food, more than half of mothers in the two groups responded that they start additional food before 6 months (54.1% and 52.6%), while 31.8% of mothers in the cases group and 43.2% of them in the control group responded that they start additional food from 6 < 8 months (P-value 0.049). All elements of food were provided more prevalent among mothers in the control group than those in the cases group (p.value 0.0001) as for offering protein to the child meals, it responded by 72.9% of mothers in the cases group and 87.3% of them in the control group, carbohydrate responded by 78.8% and 95.8%, and balanced diet responded by 5.9% and 36.8% of mothers in the cases and the control groups respectively. No statistically significant differences between the two groups were found related items of number of meals per day, regulation of feeding, manner of feeding and keeping of food.

Table (6) shows the relationship between mothers' educational level and level of their practices

regarding breast-feeding in both groups. No statistically significant difference was found between mothers educational level and levels of their practices regarding breast feeding either in the cases or in the control groups. 71.1% of mothers with unsatisfactory level of practices regarding breast feeding in the cases group compared with 52.8% of those in the control group were illiterate, while 11.7% of mothers with satisfactory level regarding practices of breast feeding in the cases group compared with 42.3% of those in the control group had secondary level of education.

Statistically significant difference was found between mothers in the cases and the control groups and levels of their practices regarding breast feeding with higher satisfactory level observed among illiterate mothers in the cases group than those in the control group 65% and 39.2%, respectively (P. 0.025). While lower satisfactory level of breast feeding practices was observed among mother secondary level of education in the cases group than those in the control group (11.7 % and 42.3% respectively. P. value 0.000).

Table (7) shows the relationship between mothers' educational level and levels of their practices regarding artificial feeding in the both groups. No statistically significant difference between level of education and practices of artificial feeding among mothers in the cases or in the control groups. 26.1% of mothers with satisfactory level of artificial feeding practices in the cases compared with 54.8% of those in the control groups were had secondary education while (81.8%) of mothers with unsatisfactory level in their practices of artificial feeding in the cases group compared with 100% of them in the control group were illiterate.

Statistically significant differences was found between illiterate mothers in the cases and those in control groups and levels of their practices regarding artificial feeding with higher prevalence of satisfactory level of practices observed among mothers in the cases than those in the control groups 60.9 % and 35.5% respectively. (P value 0.000)

Table (8) shows the relationship between mothers' educational level and levels of their practices regarding additional and adult food in both groups. No statistical significant difference was found between mothers educational level and levels of their practices regarding additional and adult in the cases and the control groups, 14.9% and 45.9% of mothers with satisfactory level of in the cases and the control groups, respectively, had secondary level of education, while 61.1% and 38.1% of those with unsatisfactory level in their practices regarding additional and adult food in the cases and the control groups, respectively, were illiterate.

Table (9) shows the relationship between socioeconomic status of mothers and levels of their practices regarding artificial feeding in the both groups. No statistically significant difference was found between socioeconomic status of the mothers and levels of their practices regarding artificial feeding in the cases and the control group, unsatisfactory level of practices was more prevalent among mothers in the middle socioeconomic status in the both groups, 87.9% and 66.7% of mothers in the cases and the control groups, respectively.

Statistically significant difference was found between mothers with middle socioeconomic status in the cases and those in the control groups and levels of their practices regarding artificial feeding with higher prevalence of satisfactory level of practices observed among mothers in the cases than those of control groups (65.2 % and 61.3 % P. value 0.000).

Table (10) shows the relationship between socioeconomic status and mother practice regarding to breast-feeding in both groups. Statistically significant difference was found between socioeconomic status and mothers' practices regarding to breast-feeding in the control group (P-value 0.003), 73.3 % and 55.7% of mothers in the cases and the control groups respectively with satisfactory level in their practices of breast feeding were in the middle socioeconomic status. The table also shows statistically significant differences were found between mothers with middle and low socioeconomic status in the cases and the control groups and levels of their practices regarding breast feeding with higher satisfactory levels of practices among mother with middle socioeconomic status in the cases than those in the control groups (73.3% and 55.7 %, respectively, P 0.025) as well as lower satisfactory levels of practices among mothers with lower socioeconomic status in the cases than those in the control groups (11.7% and 37.1% , respectively, p. value 0.010).

Figure (1) shows comparison between socioeconomic class among parents in the cases and the control groups, statistically significant difference between the cases and the control groups was found regarding socioeconomic class among parents with high prevalence of the middle socioeconomic class in the both groups (74.7% and 64%, respectively). Also the high socioeconomic class was constituted in 9.3% of parents in the cases and 28% of those in the control groups.

Fig(2) shows the relationship between socioeconomic status and mothers' practices regarding additional and adult food in the both groups. No statistically significant difference was found between socioeconomic status the mothers practices regarding additional and adult food either in

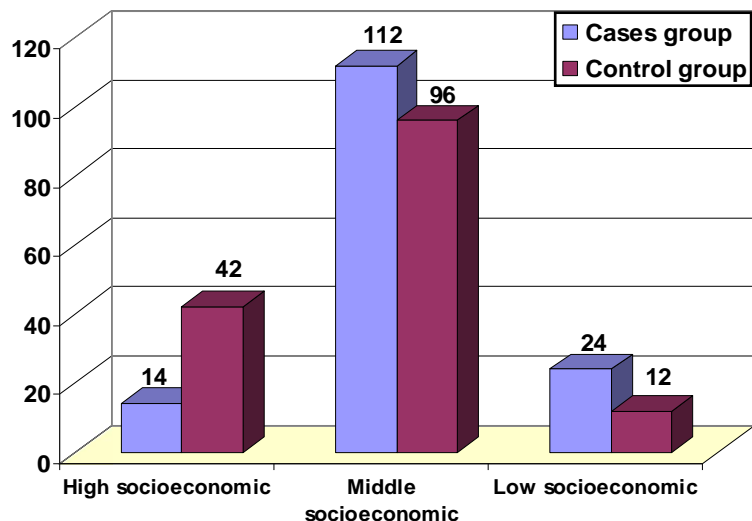


the cases or in the control groups, satisfactory level of practices regarding additional and adult food was more prevalent among mothers in the cases group than those in the control group were constituted in the high and the middle socioeconomic status. 19.4% and 5.4% of mothers in the cases and the control groups, respectively, for the high socioeconomic status, 73.1% and 59.5 % of mothers in the cases and the

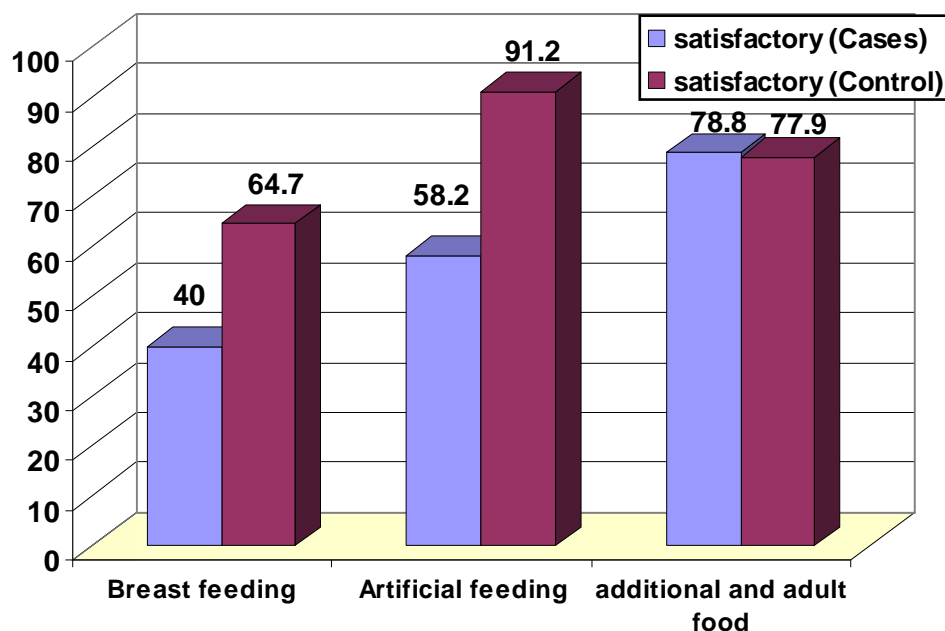
control groups respectively for the middle socioeconomic status.

No statistically significant differences were found between socioeconomic status of mothers in the cases and the control groups and levels of their practices regarding additional and adult food.

**Figure (1): Comparison between the socioeconomic class among parents of children in the cases and control group**



**Fig 2: The relationship between socioeconomic status and mothers' practices regarding additional and adult food in the both groups**



**Table (1): Comparison between cases and the control groups regarding identification data of their mothers:**

Item	Cases group (n = 150)		Control group (n = 150)		Chi-square	P-value
	No	%	No	%		
Age of the mother					3.290	0.349
20 years <	102	68.0	115	76.7		
30 years <	44	29.3	35	23.3		
40 years and more	4	2.7	0	0		
Educational level					28.259	0.000*
Illiterate	103	68.7	66	44.0		
Basic education	21	14	21	14		
Secondary	20	13.3	55	36.7		
University	6	4.0	8	5.3		
Working condition					0.561	0.454
Working	7	4.7	10	6.7		
House wives	143	95.3	140	93.3		
Residence					0.000	1.000
Urban	11	7.3	11	7.3		
Rural	139	92.7	139	92.7		
Number of children in family					6.521	0.038*
1 – 2	61	40.7	82	54.7		
3 – 4	52	34.7	44	29.3		
5 and more	37	24.6	24	16		
Family size					15.956	0.000*
< 4 persons	18	12.0	44	29.3		
5 – 6 persons	32	21.3	35	23.3		
7 and more	100	66.7	71	47.3		
Marital status					2.014	0.365
Divorced and widow	1	1.7	3	2		
Married	149	99.3	147	98		
Mother have diseases	17	11.3	14	9.3	324	0.569
Time between the current child and the next pregnancy					6.894	0.075
< 4 months	6	4	-	-		
More than 4 months	14	9.3	15	10.0		

\* Statistically significant at  $p < 0.05$ **Table (2) : Comparison between cases and control groups of children regarding to their identification data:**

Item	Cases group (n = 150)		Control group (n = 150)		Chi-square	P-value
	No	%	No	%		
Age of the child					11.988	0.002*
2m < 1 years	78	52.0	91	60.7		
1 < 3 years	63	42.0	38	25.3		
3 – 5 years	9	6.0	21	14.0		
Sex					2.000	0.157
Male	84	56.0	96	64.0		
Female	66	44.0	54	36.0		
Birth order					9.973	0.076
First	29	19.3	48	32.0		
Second	33	22.0	38	25.3		
Third	3	2.0	29	19.3		
Fourth	20	13.3	13	8.7		
Fifth and more	35	23.4	22	14.7		
Diagnosis						
Marasmus	138	92.0	-	-		
Kwashiorkor	8	5.3	-	-		
Marasmic Kwashiorkor	4	2.7	-	-		
Incomplete Vaccination	14	9.3	23	15.3	2.497	0.114
History of malnutrition in other siblings	32	21.3	4	2.7	24.747	0.000*

• Statistically significant at  $p < 0.05$

**Table (3) : Comparison between the cases and the control groups of children regarding their feeding pattern**

<i>Item</i>	<b>Cases group (n = 150)</b>		<b>Control group (n = 150)</b>		<b>Chi-square</b>	<b>P-value</b>
<b>Type of feeding offering since birth</b>						
Breast feeding	150	100	150	100	16.47	0.0002*
Artificial feeding	79	52.7	34	22.7		
Additional and adult food	85	56.7	95	63.3		
<b>Type of milk</b>	<b>(n=79)</b>		<b>(n=34)</b>		7.64	0.050*
Cow	24	30.4	9	26.4		
Buffalo	8	10.1	6	17.7		
Powder	34	43.0	19	55.8		
Mixed	13	16.5	0	0		
<b>Causes of artificial feeding</b>					16.01	0.0011*
Breast problem	11	13.9	7	20.6		
Little amount of milk	50	63.3	20	26.8		
Working of the mother	6	7.6	10	29.4		
Multiple cases	38	48.1	5	14.7		
<b>Method of feeding</b>					7.28	0.0262*
By bottle	47	59.4	27	79.4		
By cup	26	32.9	3	8.8		
By spoon	6	10.7	4	11.8		

\* Statistically significant at  $p < 0.05$ 

# More than one type of feeding responded by the mother and more than one cause of artificial feeding responded by a mother.

**Table (4): Comparison between the cases and the control groups of children regarding their mothers' practices related to artificial feeding:**

<b>Item</b>	<b>Cases group (n = 79)</b>		<b>Control group (n = 34)</b>		<b>Chi-square</b>	<b>P-value</b>
	<b>No</b>	<b>%</b>	<b>No</b>	<b>%</b>		
<b>Preparation of artificial feeding</b>						
Hand washing	71	89.9	34	100	3.705	0.100
Wash equipment	75	94.9	34	100	1.785	0.100
Boiling bottle for 10 minutes	27	34.2	28	82.4	23.328	0.000*
Boiling nipple and cover for 3 minutes	21	26.6	27	79.4	27.131	0.000*
Boiling water for 5 minutes	46	58.2	30	88.2	9.719	0.000*
Determine the correct amount of water and powder	39	49.4	28	82.4	5.803	0.025*
Shake the bottle well	52	65.8	26	76.5	1.260	0.100
Check temperature	61	77.2	31	91.2	2.923	0.100
Put the child in correct position	54	68.4	31	91.2	6.642	0.001*
Eruption of the child after feeding	37	46.8	28	82.4	12.311	0.000*
Skip the remaining part of feeding	54	68.4	34	100	13.816	0.000*

\* Statistically significant at  $p < 0.05$

**Table (5) : Comparison between the cases and the control groups of children regarding their mothers' practices related to additional and weaning food:**

<i>Item</i>	<b>Cases group</b>		<b>Control group</b>		<b>Chi-square</b>	<b>P-value</b>
	<b>No =85</b>	<b>%</b>	<b>No =95</b>	<b>%</b>		
<b>Time of starting additional food:</b>						
Before 6 months	46	54.1	50	52.6	7.85	0.049*
6 < 8 months	27	31.8	41	43.2		
8 < 12 months	8	9.4	4	4.2		
12 months and more	4	4.7	0	0		
<b>Element of food</b>						
Protein	62	72.9	83	87.3	25.09	0.0001*
Carbohydrate	76	78.8	91	95.8		
Vitamins	42	49.4	81	85.3		
Butter, oil	14	16.5	52	54.7		
Balanced diet	5	5.9	35	36.8		
<b>Number of meals / day</b>						
1	3	3.5	0	0	3.67	0.299
2	11	12.9	13	13.7		
3	23	27.0	21	22.1		
4 or more	48	56.5	61	64.2		
<b>Regulation of feeding</b>						
On demand	82	96.5	89	93.7	0.73	0.391
Schedule	3	3.5	6	6.3		
<b>Manner of feeding</b>						
By self	26	30.6	28	29.5	0.03	0.8705
By mother	59	69.4	67	70.5		
<b>Keeping of food</b>						
In the refrigerator	65	76.7	72	75.8	1.84	0.179
Out of the refrigerator	20	23.3	13	24.2		

| Statistically significant at  $p < 0.05$ 

|

**Table (6): The relationship between mothers' educational level and levels of their practices regarding breast feeding in the both groups:**

Item	Cases group				Control group				X <sup>2</sup>	P.value
	Satisfactory N= 60		Unsatisfactory N=90		Satisfactory N=97		Unsatisfactory N=53			
	No	%	No	%			No	%		
Educational level										
Illiterate	39	65	64	71.1	38	39.2	28	52.8	6.301*	*0.025
Read and write	2	3.3	5	5.6	1	1.0	1	1.9	0.643	<0.100
Primary	3	5.0	2	2.2	2	2.1	5	9.4	1.185	<0.100
Preparatory	4	6.7	5	5.6	7	7.2	5	9.4	0.398*	<0.100
Secondary	7	11.7	13	14.4	41	42.3	14	26.4	9.995	*0.000
University	5	8.3	1	1.1	8	8.2	-	-	1.436	<0.100
Chi-square	6.387				6.387					
P-value	0.270				0.270					

\* Statistically significant at  $p < 0.05$

**Table (7): The relationship between mothers' educational level and their practices regarding artificial feeding in the both groups:**

Item	Cases group				Control group				X <sup>2</sup>	P.value
	Satisfactory N= 46		Unsatisfactory N=33		Satisfactory N=31		Unsatisfactory N=3			
	No	%	No	%			No	%		
<b>Educational level</b>										
Illiterate	28	60.9	27	81.8	11	35.5	3	100	8.672	*0.000
Read and write	1	2.2	1	3.0	1	3.2	-	-	0.750	<0.100
Primary	1	2.2	1	3.0	-	-	-	-	Not valid	-
Preparatory	2	4.3	2	6.1	-	-	-	-	Not valid	-
Secondary	12	26.1	1	3.0	17	54.8	-	-	1.353	<0.100
University	2	4.3	1	3.0	2	6.5	-	-	0.833	<0.100
<b>Chi-square</b>	7.729				4.700					
<b>P-value</b>	0.172				0.195					

\* Statistically significant at  $p < 0.05$ **Table (8): The relationship between mothers' educational level and levels of their practices regarding additional and adult food in the both groups:**

Item	Cases group				Control group				X <sup>2</sup>	P.value
	Satisfactory N= 67		Unsatisfactory N=18		Satisfactory N=74		Unsatisfactory N=21			
	No	%	No	%			No	%		
<b>Educational level</b>										
Illiterate	43	64.2	11	61.1	25	33.8	8	38.1	0.180	<0.100
Read and write	4	6.0	-	-	1	1.4	-	-	Not valid	---
Primary	2	3.0	2	11.1	3	4.1	1	4.8	0.800	<0.100
Preparatory	6	9.0	-	-	6	8.1	3	14.3	2.500	<0.100
Secondary	10	14.9	4	22.2	34	45.9	8	38.1	0.566	<0.100
University	2	3.0	1	5.6	5	6.8	1	4.8	0.321	<0.100
<b>Chi-square</b>	<b>5.423</b>				<b>1.381</b>					
<b>P-value</b>	<b>0.366</b>				<b>0.926</b>					

\* Statistically significant at  $p < 0.05$ **Table (9): The relationship between socioeconomic status of the mothers and level of their practice regarding to artificial feeding in the both groups:**

Item	Cases group				Control group				X <sup>2</sup>	P.value
	Satisfactory N = 46		Unsatisfactory N = 33		Satisfactory N = 31		Unsatisfactory N = 3			
	No	%	No	%	No	%	No	%		
High	8	17.4	3	9.1	1	3.2	1	33.3	0.410	<0.100
Middle	30	65.2	29	87.9	19	61.3	2	66.7	10.248	*0.000
Low	8	17.4	1	3	11	35.5	-	-	1.287	<0.100
Chi-square	5.751				5.292					
P-value	0.056				0.071					

\* Statistically significant at  $p < 0.05$



**Table (10): The relationship between socioeconomic status and mothers practice regarding to breast feeding in the both groups:**

Item	Cases group				Control group				X <sup>2</sup>	P.value
	Satisfactory N=60		Unsatisfactory N=90		Satisfactory N=97		Unsatisfactory N=53			
	No	%	No	%	No	%	No	%		
High	9	15	15	16.7	7	7.2	5	9.4	1.406	<0.100
Middle	44	73.3	68	75.6	54	55.7	42	79.2	5.970	*0.025
Low	7	11.7	7	7.8	36	37.1	6	11.3	7.513	*0.010
Chi-square	0.670				11.330					
P-value	0.715				0.003*					

\* Statistically significant at  $p < 0.05$ 

#### 4. Discussion

Malnutrition is common and is responsible directly or indirectly for about half of all deaths of children under five years of age. (Baqui and Ahmed, 2006). This study was designed to identify the possible risk factor of protein energy malnutrition in children less than five years of age.

Results of the present study indicated that statistically significant differences were found between mothers in the cases and control groups regarding their educational level, as shown in table (1). As well as this study revealed that 71.1% and 52.8% of mothers with unsatisfactory level of their practices regarding breast feeding in the cases and the control groups respectively were illiterate. The majority of mothers (81.8% and 100%), with unsatisfactory level of their practices regarding artificial feeding in the cases and the control groups, respectively, were illiterate. In addition 61.1% and 38.1% of mothers with unsatisfactory level of their practices regarding additional and adult food in the cases and the control groups, respectively, were illiterate.

The lower educational level of the mothers was considered a risk factor for malnutrition in the present study. Findings of this study are in agreement with many authors as Youssef et al. (2000) who found that, the higher education level of the mothers, the better perception and estimation of malnutrition in their children, also Khin-Maung et al., (1994) found that, low level of mothers education was associated with high relative risk and high etiologic for malnutrition. They suggested that improving the educational level of mothers would be of public health importance. This also are in agreements with Thabet (2002) who examined maternal beliefs and practices in feeding young children during diarrhea and found that lower educational level of the mother consider a risk factor for malnutrition.

Results of the present study revealed that statistically significant difference was found between mothers in the cases and control groups regarding their family size, very large family size was significantly higher among the cases group in comparison to the control group. This is not unexpected as the higher the family size the lower care given to the children and the hence diarrhea transmission of infection and malnutrition. These results not agree with Thabet (2002) who found that the smaller the family size the greater the frequency of diarrhea infection. The present study also revealed that families in the cases with one or two children had higher prevalence of malnutrition among their children than those with 5 and more children; this can be explained by the lower experience of the mother with one child about mode of transmission of infection, and improper handling of feeding and weaning practices as well as other risk factors for malnutrition. This result disagree with Peltó (1991) and Khin-Maung et al., (1994) who described that, mothers with more than three children is among risk factors for diarrhea and malnutrition

statistically significant difference was found between parents in the cases and those in the control groups regarding their socio economic status with higher percentages of middle and low socio economic status among parents in the cases than those in the control groups as shown in figure (1) as well as more than three quarters of mothers in cases group with unsatisfactory level in their practices related to breast feeding, artificial feedings and additional and adult food were constituted in the middle socioeconomic class. These findings are supported by many authors as Wong et al. (2007) who show malnutrition more common in among children with low socio economic level, also Debra et al. (2008) stated that poor economical status and social structure are the important factor for the development of malnutrition and added that nutritional deficiency condition are

by-product of bad economy, insufficient education, ignorance, lack of knowledge regarding food values, inadequate sanitary environmental, large family size, disturbed family, (broken family) closely spaced families with repeated pregnancies, working mothers, infant with low birth weight and premature.

Result of the present study indicated that statistically significant differences were found between children in the cases and the control groups related to their age with high percentages of children in the cases group in the age ranged from 1 to less than 3 years, and history of malnutrition in other sibling. This could be attributed to inadequate intake of food because mothers' ignorance regarding food values and unsatisfactory levels which obtained in their practices related to feeding of children (breast feeding, artificial feeding and additional and adult food)

The present study revealed that more than half of children in the cases group (52%) who had malnutrition their ages were less than one year, this can be explained that food supply did not meet rapid rate of growth in the first years; besides the effect of malnutrition may not be in fact apparent until approximately 4 months after it has an effects on weight velocity. Finding of the present study is in the line with those obtained by Seward et al 1994 who showed that malnutrition is more prevalent among children aged from 2 months to less 1 years related to rapid growth in infancy and improper handling of weaning practices also finding of the present study agree with Sabry (2004) who found that the majority of children with malnutrition (94%) their age ranged from 6 to less than 15 months and illustrated that 33.3% of children in the age group ranged from 6 to 24 months exposed to under nutrition. Penny (2003) reported that the high incidences of marasmus were found to be more common among children aged between 6 to 12 months.

Results of the present study noted that fourth, fifth and more birth order constituted in 36.7% of children in the cases group compared with 23.4% of those in the control group while the first birth order was constituted in 19.3% and 32% of children in the cases and the control group respectively with no statistically significant difference as shown in table 2. This could be attributed to overcrowding, poor health of the mother from recurrent pregnancy and labor and inability to provide good rearing for the child. Finding of the present study is supported by those of Thabet (2002) and Sandy et al., (2004) who reported that children who were of the fifth or higher birth order had significantly higher risk for malnutrition when compared with those who were of the first or second birth order.

Healthy growth is achieved through correct diet, during the initial stage of life, human milk, undoubtedly, the food that most unites the ideal nutritional characteristics, with the correct balance of nutrients. Furthermore, it aids in the development of innumerable immunological and psychological advantages which are important to the reduction of infant morbidity and mortality. Breast milk is important to the child, the mother, thier family and society in general (Mishref, 2007).

As regarding type of feeding, the present study revealed that breast milk was offered to all children (100%) either in the cases or in the control groups while artificial feeding was more prevalent among children in the cases than those in the control groups (52.7 % and 22.7%, respectively) with statistically significant difference. In addition the present study indicated that using of powder milk and bottle was most popular among children in the cases and those in the control groups with statistically significant differences. So exposure of children to artificial feeding, using powder milk and bottles are considered risk factors of malnutrition among children because the powder milk is expensive, the mother at that time dilute the formula which affect the constitution of milk and lead to inadequate intake of suitable food elements as well as improper preparation of artificial feeding which was observed in the present study among mothers in the cases group compared with those in the control group with statistically significant differences related items of boiling bottle for 10 minutes, boiling nipple and cover for 3 minutes, boiling water for 5 minutes, determine the correct amount of water and powder, shake the bottle we, check temperature and skip the remaining part of feeding.

Breast feeding influences hormones such as ghrelin, leptin and IGF in infancy, mainly during the first 4 months of life. Further evidence by Pelletier et al. (2001) reported that breast feeding have higher serum leptin. The presence of leptin in breast milk might have a significant role in growth, appetite and regulation of nutrition in infancy, especially the early lactation period.

Ziegler et al., 2003 stated that some time before the infant is born is whether the infant will be breastfed or formula-fed. In the control group the most common feeding is the breast feeding (54%) it is agree with Food and Agriculture Organization (2000) which considered breast milk the natural food for full-term infant during the first months of life, it is always available the proper temperature and requires no preparation time. Breast milk alone provides adequate nutrition through the first 6 months of life and breast milk has many advantages than formula milk it contains many substances which help in

maintaining growth of infant and protection of them from any diseases.

In addition improper handling of artificial feeding among mothers in the cases group may be considered the cause of higher exposure of their children to infections than children in the control group.

The present study revealed that there was statistically significant difference found between children in the cases and the control groups reacted to number of previous hospitalization with high percentages of hospitalization 3,4 So, recurrent hospitalization is considered risk factor to PEM in children less than 5 years. This result supported by Hendricks et al. (1995) who stated that hospitalized children are also at risk for PEM when they experience complex conditions, such as oncology disease, genetic disease, or neurological disease, requiring prolonged and complicated hospital care. In these conditions, the challenging nutritional management is often overlooked and insufficient.

As regards of children in the cases group results of the present study indicated that (56%) of them were males and (44%) of them were females. this finding was supported by Bisharat, (1998) who found that child care practices during diseases vary according to the sex of the child. Male children were also brought to the diarrhea treatment center at the nearest major hospital more often than females children and female children were significantly more ill when they were brought for treatment. this might be related to cultural factors that mothers are more anxious about their male children than females. While Kleigman, et al. (2006) stated that no sexual predilection exists and Sabry 2004 showed that malnutrition is common in females than male this may be attributed to the presence of discrimination in feeding and rearing patterns of boys compared of girls especially in rural areas

Result of the present study indicated that statistically significant differences were found between children the cases and the control groups regarding their mothers' practices related to time of starting additional food and elements of food about half of mothers delayed starting additional food to their children after 6 months in the both groups but 14.1% of children in the cases compared with 4.2% of them in the control group exposed to additional food from 8 and more months as well as food elements as protein, carbohydrates, vitamins, butter, oil were offered in less frequently for children in the cases group than those in the control group as shown in table (5). These results are congruent with those obtained by Fernando 1991, Youssef (2000).

The report of WHO (1996) emphasized that, because of a great importance of early weaning and

the characteristic of weaning food it is essential to start weaning foods at 6 months of age in addition to being high quality food. Also it recommended exclusive breast feeding for 6 months and weaning starts at 6 months.

The order of food introduction, as well as specific amount to be given, are based on tradition rather than on scientific studies (Behrman et al. 2006).

## 5. Conclusion

From this study it can be concluded that several risk factors were found to be associated with PEM including: Lower education level of the mother; number of children in the family as the number of children in the family decreased, the prevalence of PEM increased; low and middle family socioeconomic status; age of the child, children with the younger age are more vulnerable to have PEM than those of older age and mothers' practices regarding feeding of their children (breast feeding, artificial feeding as well as additional and adult food) unsatisfactory practices of mothers regarding feeding of their children increase the prevalence of PEM among their children.

## Recommendations

The study recommends that:

- 1- Supporting and promotion of breast feeding.
- 2- Avoid using of artificial feeding and bottles.
- 3- Health education to the mothers about proper feeding practices, breast feeding, artificial feeding and additional and adult food to prevent PEM.
- 4- Increasing mother's awareness related to risk factors of PEM and how to manage the different infections among their children.
- 5- Encourage vaccination at the appropriate time.
- 6- Improving the educational level of mothers would be a public health importance.
- 7- The importance of continued breast feeding of the unweaned child and early feeding of the weaning one.
- 8- Increase mother's awareness related Family planning.
- 9- Health education to the mother about importance of growth monitoring to the infant or child.

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## Prevalence of Asymptomatic Bacteriuria in Antenatal Women with Preterm Labor at an Egyptian Tertiary Center

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**Abstract:** Background and objective: Urinary tract is second only to the respiratory tract in acquiring microbial infection, especially in females. It is more common in pregnant than in non-pregnant women<sup>1,2</sup>. Studies from different parts of the world have showed that urinary tract infection (UTI) during pregnancy leads to low birth weight babies, increased perinatal mortality and premature births along with acute and chronic sequelae in mothers<sup>3</sup>. This study was conducted to explore the relation of asymptomatic bacteriuria in Egyptian females to preterm labor and different aspects of UTI during pregnancy. Patients and Methods: This was a cross sectional study that was done at Ain Shams University Maternity Hospital. The study included 1830 antenatal women, over a 3-year period, between January 2007 and December 2009. Out of these patients; 780 patients had premature uterine contractions while 1050 antenatal women with no history of premature uterine contractions. Results: Prevalence of asymptomatic bacteriuria (ASB) in those with premature uterine contractions and others with no history of uterine contractions were 23.5% and 16.9% respectively. A highly significant association between ASB of the mothers and preterm labor was noted. Conclusion & recommendations: The results of this study suggested that patients with asymptomatic bacteriuria were more prone to develop preterm delivery than that of the healthy mothers (without bacteriuria). The unwanted sufferings of the pregnant mothers and their offspring could easily be prevented by early screening and treatment of asymptomatic bacteriuria in pregnancy which must be considered as an essential part of antenatal care in order to reduce the morbidities associated with preterm labor.

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**Key Words:** asymptomatic bacteriuria – preterm labor

### 1. Introduction

Urinary tract infection (UTI) is one of the most common diseases encountered in clinical practice today. Urinary tract infection is not only common but the range of clinical effects varies from asymptomatic bacteriuria to acute pyelonephritis<sup>4</sup>. Urinary tract infection is the common of all bacterial infections, affecting human beings throughout their life span especially in women<sup>5</sup>. Nearly 50% of all women develop symptoms of urinary tract infection at some stage during their life. The urinary tract undergoes profound physiological and anatomical changes during pregnancy facilitating the development of bacteriuria both symptomatic and asymptomatic in women<sup>6</sup>. Symptomatic bacteriuria is an iceberg of total bacteriuria. Pregnancy is a provocation for the asymptomatic to become symptomatic<sup>7</sup>. About 10% Of those with asymptomatic bacteriuria develop symptomatic bacteriuria during pregnancy<sup>8</sup>. Symptomatic bacteriuria poses no problems because it is easy in diagnosis and treatment due to its overt symptoms but asymptomatic bacteriuria is difficult to diagnose and it is more common in pregnant women than non-pregnant women<sup>9</sup>. Asymptomatic bacteriuria is

especially important in pregnancy because 30-40% of untreated pregnant women with asymptomatic bacteriuria develop acute pyelonephritis at the late pregnancy<sup>10,11</sup>. Also there is evidence that when there is no symptom, untreated bacteriuria in pregnancy may lead to less favorable pregnancy outcomes and complications like preterm delivery, low birth weight, pre-eclampsia and anemia of pregnancy. Prematurity is one of the leading causes of perinatal mortality. Uterine contractions may be induced by cytokines and prostaglandins, which are released by microorganisms<sup>10,12</sup>. Very little is known about possible biological mechanisms of preterm labor in women with asymptomatic bacteriuria, but a few studies on this subject have been published. However, despite the fact that the synthesis of both estrogen and progesterone is known to increase throughout pregnancy, the incidence of bacteriuria does not increase as the pregnancy approaches term<sup>13</sup>. Thus, any mechanical changes associated with estrogen do not appear to be responsible for asymptomatic bacteriuria in pregnancy. Kass<sup>14</sup> reported that severe uterine contractions occur within moments after endotoxin injection in an animal model, thus linking bacteriuria with early delivery. Furthermore, Apitz<sup>15</sup>



reported that endotoxin causes a generalized Shwartzman reaction in the pregnant rabbit. Zahl and Bjerknes<sup>16</sup> used the same substance to induce decidual - placental hemorrhage in the female mouse. Also, as gestation lengthens, the uterus was shown to be progressively more susceptible to endotoxin, and some, but not all, rabbit wombs primed with estrogen and progesterone exhibited uterine hyperirritability. Conversely, the uterus of the nonpregnant rabbit did not react at all. Thus, gestation somehow sensitizes the uterus to these powerful oxytocics, and, when the situation is complicated by bacteriuria due to gram-negative organisms, the endotoxins elaborated by the organisms causing infection could theoretically precipitate preterm labor.

The present study was undertaken to estimate the prevalence of asymptomatic bacteriuria as a causative agent in cases of preterm labor and because asymptomatic bacteriuria in pregnancy remains prevalent and preventable, a review of this important subject is relevant at this time.

## 2. Patients and Methods:

Material for the present study consisted of 780 urine samples (cases group) obtained from pregnant women attending as outpatients & inpatients admitted at Obstetric department of Ain Shams University Maternity Hospital, during the years 2007 to 2009 with history of premature uterine contractions and 1050 urine samples (control group) obtained from pregnant patients with no history of preterm labor.

**Inclusion criteria:** Age ranging between 20 - 40 years, any parity, gestational age less than 37 weeks, singleton, no history of rupture of membrane (ROM), no history of preterm labor in previous pregnancies.

**Exclusion criteria:** well known cases of uterine malformations, multiple pregnancy, history of ROM, history of previous preterm labor.

Data were collected on a predesigned proforma and patients were instructed to collect only mid stream sample of urine into sterile bottles. These were transported within half an hour to the laboratory and processed without delay. Specimens were subjected to cultures by the standard loop technique on blood agar, MacConkey's agar and nutrient agar. Specimens were processed by screening methods namely a) counting of pus cells in the uncentrifuged urine using slide micrometry method (a value of 10 cells/cumm or more corresponds to pyuria and signifies the presence of UTI); b) Gram staining of the urine smear by Jensen's modification (presence of at least one organism per oil immersion field was taken

to correlate with significant bacteriuria of more than 10 cfu/cumm, discarding as negative after examining at least 20 fields); c) Triphenyl Tetrazolium Chloride (TTC) Test; and d) Catalase Test. All the specimens that yielded positive results by any one of the above four screening methods were subjected to culture by the pour plate method. Colonies were counted from plates which showed between 50 and 400 colonies per plate. Colonies were counted on a colony counter. The specimens were classified into significant with counts being those equal to or more than  $10^5$  cfu/mL. The significant bacterial isolates were identified by standard procedures and subjected to antibiotic susceptibility by disc diffusion method. Patients yielding a positive culture for a second time by the same organism were advised antibiotic treatment. Cultures were repeated after a three day course to make sure that the infection was controlled.

**Statistical Analysis:** Analysis of data was done by using SPSS (statistical program for social science 12) as follows:

- Description of quantitative variables as mean and SD and range.
- Description of qualitative variables as number and %.
- Unpaired t-test was used to compare two groups as regard a quantitative variable.
- Chi-Square test was used to compare qualitative variables between groups.
- P value > 0.05 insignificant, P<0.05 significant (\*) & P<0.01 highly significant (\*\*)

## 3. Results

This study was carried out in Ain Shams University Maternity Hospital on 1830 antenatal mothers. They were divided into two groups; group I (cases group) were 780 patients with history of preterm labor and group II (control group) were 1050 pregnant females with no history of preterm labor. They were compared as regards the mean age and parity with no significant difference between the two groups (table 1).

The incidence of asymptomatic bacteriuria (ASB) in group I (cases) was 23.5% while the incidence of in group II (control group) was 16.9% with highly significant difference between the two groups. As regards the prevalence of positive urine cultures in the two groups the incidences were 95.1% (175) and 81.9% (145) in group I and II respectively with highly significant difference between the two groups (table 2).

**Table (1) shows the clinical characteristics of the patients under the study**

variable	Cases group (n = 780)	Control group (n = 1050)	t- value	P- value
Age (years)	22.1 ± 1.1	21.6 ± 1.3	0.8	0.43
Parity	2.8 ± 1.1	2.9 ± 2.1	1.23	0.22

Values are expressed as means ± standard deviation or number and percentage.  
No significant difference between the two groups in all variables (P value > 0.05)

**Table 2: Comparison between the two groups in the incidence of ASB and the prevalence of positive urine cultures.**

Variable	Cases group (n = 780)	Control group (n = 1050)	Chi- square	Odds ratio	Relative risk	P- value
ASB*	184 (23.5%)	177 (16.9%)	12.811	1.523	1.399	< 0.001
Positive cultures	175 (95.1%)	145 (81.9%)	15.585	4.291	1.161	< 0.001

\*ASB: asymptomatic bacteriuria

Highly significant difference between the two groups in all variables (P value &lt; 0.001)

Out of the 1,830 pregnant mothers screened in this study, 361 (19.7%) had asymptomatic bacteriuria. The commonest organism causing

bacteriuria was *Escherichia coli*. The prevalence of different types of causative organism in both groups of bacteriuria was more or less the same (Table 3).

**Table 3: comparison of the prevalence of causative agents of bacteriuria in the two groups**

Causative organisms	Percentage in cases	Percentage in control
<i>E coli</i>	56	61
<i>Candida albicans</i>	10	8
Group B streptococci	9	11
Staphylococci	8	9
<i>Klebsiella</i>	10	9
<i>Proteus</i>	5	2

The sensitivity pattern of the isolated organisms revealed that all were highly sensitive to ceftriaxone and moderately sensitive to cephalixin,

erythromycin, nitrofurantoin, amoxicillin-clavulanic acid ranging 24 to 72%. (Table 4)

**Table 4 Shows the sensitivity of different organisms to different antibiotics**

	<i>E. coli</i>	Group B streptococci	Staphylococci	<i>Klebsiella</i>	<i>Proteus</i>
Cephalexin	52.3	68.6	63.8	44.6	72.4
Erythromycin	37.3	24.8	44.5	35.9	49.8
Nitrofurantoin	55.1	44.2	56.5	27.5	34.4
amoxicillin-clavulanic acid	61.7	67.1	41.8	39.7	51.1
Ceftriaxone	87.2	78.8	79.7	66.9	75.1

#### 4. Discussion

Asymptomatic bacteriuria (ASB) occurs in 2-10% of all pregnancies<sup>17</sup>. The majority of the most recent studies<sup>17-24</sup>, including observational studies

from developing countries found the prevalence of asymptomatic bacteriuria in pregnant women ranged between 4-10%. This range during pregnancy was reported to be as high as 78.7% in a population from

Nigeria. This variation in studies can be attributed to several factors such as the geographical variation, socio-economic status, ethnicity of the subjects, setting of the study (primary care, community based, or hospitals), and the variation in the screening tests (urine dipstick, microscopy, and culture). Race-specific rates show significant variation, as well as there is variation within same race living in different geographical areas or with socio-economic status. Thus, it is important to evaluate the prevalence of ASB in a specific population. This study reported that the prevalence of ASB among pregnant women attending prenatal visits in a tertiary center in Cairo was 23.5% in patients with premature uterine contractions and 16.9% in control patients (95% CI, Chi Square 12.811, Odds Ratio 1.523, relative risk 1.399, P value < 0.001) with highly significant differences between the two groups. The reported prevalences of ASB were 30%, 4.8%, 9.9% and 3.3-6.1% among pregnant women in Yemen<sup>19</sup>, United Arab Emirates (UAE)<sup>18</sup>, Qatar<sup>24</sup> and Iran<sup>25</sup> respectively.

Our findings regarding perinatal complications in patients with ASB confirm the conclusion of Hazhir et al. 2007<sup>22</sup> who showed significant bacteriuria in preterm group and term group of 36% and 12% respectively. There are many studies<sup>10, 14-16</sup> that link so many pregnancy complications like hypertensive disorders in pregnancy, low birth weight, premature with asymptomatic bacteriuria. The results of the present study also agree with these findings. The association between asymptomatic bacteriuria and pregnancy complication especially prematurity is out of question, it is now an established fact<sup>7-9</sup>. But the mechanism is not well defined to the researchers. Several investigators have observed a high incidence of pyelonephritis in bacteriuric pregnant mothers<sup>26</sup>. It is convincing that the effect of urinary tract infection on premature labor could be indirectly mediated by antenatal maternal hypertension. It is also plausible that urinary tract infection affects premature labor directly, through the development of amnionitis. It has been previously suggested that bacterial infection of the amniotic fluid is a risk factor for premature delivery<sup>17, 18</sup>. Another hypothesis contends that bacterial enzymes such as collagenase may weaken the fetal membranes and predispose them to premature rupture<sup>19</sup>.

*E. coli* has been identified as the most common pathogen isolated among the pregnant women in this study, which was consistent with the majority of the reported studies in literature<sup>13-19,22-24,27,28</sup>. However, *E. coli* formed 56% of the isolated organisms in the cases group, and 61% in the control group which is lower than what have been reported in

countries such as Turkey 2005 (77%)<sup>17</sup>, UAE 2005 (66.7%)<sup>18</sup>, Iran 2009 (70%)<sup>25</sup> and in Pakistan 2006 (78.6%)<sup>20</sup>. Moreover, higher than in Nigeria 2006 (11.1%)<sup>21</sup> and Qatar 2009 (31%)<sup>24</sup>. *E. coli* is the most common microorganism in the vaginal and rectal area. Because of the anatomical and the functional changes that occur during pregnancy, the risk of acquiring UTI from *E. coli* is high<sup>14</sup>. It is consistent with the findings of Rahman et al. (1990)<sup>30</sup> and Ahmed et al. (1996)<sup>31</sup>. The findings of the study showed that staphylococcus Saphrophyticus, which was formerly believed to be normal commensal, was recognized as a pathogen accounting overall 8% of bacteriuria in this community.

The presence of *Candida albicans* in this present study is 10 and 8% in the cases and control groups respectively and is higher than other studies<sup>14,27</sup>, Nigeria, 2006<sup>21</sup> (7.9%) and Malaysia, 1997<sup>27</sup> (2 out of 32 cultures; 6.25%). The physiological alterations during pregnancy that affects immunity and high prevalence of diabetes, including gestational diabetes, among our population may account for this high prevalence of *C. albicans*. Group B streptococcus (GBS), which is occasionally isolated in urine (10%)<sup>29</sup> had a prevalence of 9% in this study. GBS bacteriuria may be associated with preterm rupture of membranes, premature delivery, and early onset neonatal sepsis. Thus, all pregnant women with these bacteria during gestation should receive treatment at the time of diagnosis, as well as intrapartum antibiotic prophylaxis<sup>2,32</sup>. The result in our study is less than those reported from Malaysia (17.2%)<sup>27</sup> and less than 25.5% reported by Amadi et al. from Nigeria<sup>26</sup>.

Like other studies<sup>10, 13</sup> the findings of the study also indicate that ceftriaxone is highly effective to the urinary pathogens. Rahman et al.<sup>30</sup> in 1990 in their study observed that urinary pathogens at very high percentage ranging 75 to 100% were sensitive to cephalixin, nitrofurantoin and nalidixic and ranging from 50 to 100% were sensitive to co-trimoxazole in non diabetic patients. The findings of this study did not consistent with the findings of Rahman et al. This fact indicates that urinary pathogens became resistant day by day to the commonly used antibiotics in our country. This may be due to wide spread and indiscriminate use of the drugs.

In a meta-analysis performed by Romero et al.<sup>33</sup>, only selective studies were evaluated. For studies to qualify for the analysis, the definitions of asymptomatic bacteriuria had to be clearly specified, the numerical data for the outcome variables had to be reported individually, and, in studies using the randomized clinical trial design, a control group was required in the treatment trials. Because of a failure to satisfy these requirements, 12 of 31 studies were

excluded from analysis; eight of the 19 qualified studies were randomized clinical trials. Most of the acceptable studies required that two clean-catch urine specimens contain at least  $10^5$  organisms/ mL to be considered to represent true infection, as opposed to contamination. When data were pooled in the meta-analysis, bacteriuric mothers were found to have a 54% higher risk of giving birth to a low-birth-weight infant and twice the risk of giving birth to a preterm infant than did nonbacteriuric mothers. Furthermore, a meta-analysis including only randomized clinical trials showed that antibiotic treatment of bacteriuric mothers significantly reduced the risk of low birth weight (relative risk = 0.56; 95% confidence interval = 0.43-0.73). Thus, maternal bacteriuria is a risk factor for premature delivery that can be reduced by treatment with appropriate antibiotics.

### 5. Conclusion:

In conclusion, the result of this study found that the prevalence of ASB among pregnant women with preterm labor in a tertiary center in Cairo, Egypt was high (23.5%), and the predominant organism of *E. coli* was 56%. A large scale national study that includes primary health care centers should be conducted to determine the actual prevalence of ASB in the obstetric population in Egypt, and to identify the group that is vulnerable for developing a UTI. If low prevalence is confirmed at the national level and vulnerable groups are identified, it is more cost effective to recommend selective rather than universal screening for ASB in pregnancy. To the best of author knowledge this the only recent paper reporting prevalence of ASB among pregnant women in Cairo, persistent asymptomatic bacteriuria in pregnancy causes different types of serious complications like pyelonephritis, hypertensive disorders, low birth weight, premature labor, anemia etc, which are the leading causes of high maternal and infant morbidity

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## Cultural Awareness about Female Genital Mutilation among Female Employees of Minia University

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**Abstract :** Female genital mutilation (FGM) is a reflection of the violation of women's basic human rights. The new prohibiting laws In Egypt seem to have no significant effect on its prevalence. The aim of this study was to assess the awareness and attitudes of women in Upper Egypt regarding FGM, and to identify the underlying motives that may help in change. This cross-sectional study was conducted on convenience sample of 300 women working in Minia University, Upper Egypt. Data were collected using an interview questionnaire including an attitude scale. Data collection lasted from 19/11/2009 to 17/5/2010. Women's age ranged between 18 and 60 years, and 30.7% were illiterate; 95.7% of women and 77.3% of their daughters were circumcised. The attitude towards FGM was generally encouraging it. Multivariate analysis showed that lower education and having been circumcised were the statistically significant independent predictors of the attitude score. Meanwhile, the determinants of getting daughter circumcised were woman's older age, religious belief, lower education, and more encouraging attitude score. It is concluded that FGM is still an important and culturally sensitive issue in Upper Egypt, and most women, especially with low education, encourage it mainly on religious grounds. Health education efforts should be more focused on illiterate women, and must be supported by religious scholars.

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**Key words:** complication, cultural background, female circumcision, genital mutilation.

### 1. Introduction:

Female genital cutting, termed female genital mutilation (FGM), pertains to any interventions that may involve injury or removal of the female external genitalia either partial or complete for any reasons other than therapeutic<sup>(1)</sup>. The practice was first known as female circumcision, but since the late 1970s this was replaced by the term FGM to give a better reflection of the violation of the woman or girl's basic human rights<sup>(2)</sup>.

Despite the efforts combating this practice, still millions of women worldwide are affected. About 100 million women and girls worldwide have undergone FGM, and about 2 million girls are at risk each year.<sup>(3)</sup> It is currently practiced in many countries, specifically in Africa, Middle East, and other parts of Asia. Nevertheless, no true worldwide prevalence rates are available because of the inconsistent reporting and poor documentation, and the variations in the quality of informants. The perpetuation of FGM is often related to religious beliefs although many scholars deny it<sup>(1)</sup>.

The age at performing FGM varies between early infancy and just before marriage<sup>(4)</sup>. The practitioner is often not trained or licensed<sup>(5)</sup>. This, added to the unsterile conditions in which the

procedure is performed, leads to increased risk for acute complications that may end up with posttraumatic stress disorders and even fatalities<sup>(6)</sup>, in addition to long-term obstetric and sexual complications<sup>(7-9)</sup>.

In Egypt, a 1995 ministerial decree forbade FGM under sanctions of fine and imprisonment for perpetrators, as well as loss of practice license. Following ministerial decrees prohibited non-medical practitioners from practicing any form of FGM, and physicians in governmental healthcare settings. More recently, FGM was prohibited in all public or private facilities and by medical and non-medical practitioners, except for approved medical reasons. Nevertheless, FGM is still widely practiced in Upper Egypt<sup>(10)</sup>, and the issue is still controversial among the Egyptian medical professionals<sup>(11)</sup>. The results of the recently-released 2005 EDHS have not shown a significant decline in the practice<sup>(12)</sup>. The new law in Egypt seems to have no significant effect on the prevalence<sup>(13)</sup>, and despite increased international efforts to end FGM, there is little evidence of its decline<sup>(14)</sup>.

Since the change of the attitude is the first step toward effecting a change in behaviors, it is of great importance to identify the factors that may

convince people to modify their deeply rooted traditional beliefs regarding FGM. This would help in planning and designing custom-tailored health education programs targeted to specific groups deemed amenable to change. Hence, the aim of this study was to assess the awareness and attitudes of women in Upper Egypt regarding FGM, and to identify the underlying motives that may help in change.

## 2. Subjects and methods:

The study was conducted at Minia University, Upper Egypt. It has 17 faculties, 14 of which are science specialties, and three are arts. A descriptive cross-sectional design was used. The study population consisted of all female employees of Minia University at the time of data collection. Their total number was 734. A convenience sample of 300 women was selected from this population with the criteria of being married and having at least one daughter. This sample size was large enough to detect a prevalence of positive (rejecting) attitude towards FGM of 50% or higher and 5% absolute precision at 95% level of confidence and about 20% dropout rate using a sample size equation for a single proportion and with finite population correction<sup>(15)</sup>. The total sample was divided equally among the 17 faculties.

The data were collected using an interview questionnaire form developed by the researcher based on rigorous review of the literature, and validated through the opinions of nursing and medical experts in obstetrics and community health. The form covered woman's demographic data and the history of circumcision for the woman and her daughter. It also included awareness about illegalization of FGM and its religious aspects. A 3-point Likert scale for attitude (agree, uncertain, disagree) was designed and included 12 positive and negative statements soliciting opinions regarding issues related to FGM as reasons for encouraging or discouraging, chastity and honor, sexual arousal, hygienic aspects, etc. The reliability of the scale was high (Cronbach alpha=0.774). The responses "agree", "uncertain", and "disagree" were respectively scored 2, 1, and 0. The scoring was reversed for negative statements so that a higher score reflects a positive or discouraging attitude. The scores of the items were summed-up and the total divided by the number of the items, giving a mean score. These scores were converted into a percent score. The attitude was considered positive if the percent score was 60% or higher and negative if less than 60%.

The study protocol was approved by the University research committee. After securing official permissions, the researcher started the fieldwork. The administration of each of the 17

faculties was approached to explain the purpose of the study and seek cooperation. A sample of convenience of about 20 female employees and workers were recruited from each faculty according to the eligibility criteria. Each participant was met individually by one of the researchers who explained to her the aim and procedures of the study. An informed verbal consent was obtained from each participant before recruitment in the study sample. Upon acceptance, she was interviewed using the questionnaire form. The study maneuver could not entail any possible harmful effect on participants. The data collection procedure lasted from 19/11/2009 to 17/5/2010.

Data entry and statistical analysis were done using SPSS 14.0 statistical software package. To identify the independent predictors of the attitude score, multiple linear regression analysis was used after testing for linearity. To identify the independent predictors of daughter circumcision, multiple logistic regression analysis was used. Statistical significance was considered at p-value <0.05.

## 3. Results:

The age of women in the study sample ranged between 18 and 60 years, with mean about 40 years (Table 1). Slightly more than half (52.0%) of them were from rural areas, and about one-third (30.7%) were illiterate. The majority (92.0%) were Moslems.

Table 2 shows that almost all of the women (95.7%) were circumcised, and more than three-fourth of them (77.3%) did it for their daughters. The mean age at circumcision was slightly higher for daughters (11.8 years) compared to women (11.4 years). Also, more daughters were circumcised by doctors, and had associated complications.

The attitude towards FGM was generally negative, i.e. encouraging it. As shown in Table 3, 69.3% of the women had such negative attitude. The highest agreements upon negative attitudes were related to husbands' approval (76.0%), tradition (71.7%), and decreasing sexual arousal (68.0%), while the least was upon improving sexual relations (36.3%).

Multivariate analysis was done to identify the predictors of women's disagreeing attitude scores regarding FGM. Table 4 shows that only education and having been circumcised were the statistically significant independent predictors of the attitude score. It is evident that education increased the positive attitude score, whereas the history of being circumcised decreased the positive attitude score, i.e. increased the agreement upon FGM.

Regarding the determinants of getting daughters circumcised, Table 5 indicates that

women's older age and belief that FGM is mandated by religion were statistically significant independent positive predictors. On the other hand, higher level of

education, and positive attitude score were statistically significant independent negative predictors.

**Table 1. Socio-demographic characteristics of women in the study sample (n=300)**

	Frequency	Percent
Age (years):		
<30	39	13.0
30-	108	36.0
40-	88	29.3
50+	65	21.7
Range	18.0-60.0	
Mean±SD	40.6±11.0	
Residence:		
Urban	123	41.0
Suburban	21	7.0
Rural	156	52.0
Education:		
Illiterate	92	30.7
Basic	63	21.0
Secondary	92	30.7
University	53	17.7
Religion:		
Moslem	276	92.0
Christian	24	8.0

**Table 2. History of circumcision among women and their daughters in the study sample (n=300)**

	Frequency	Percent
Have been circumcised	287	95.7
Age at circumcision:		
Range	5-16	
Mean±SD	11.4±2.0	
Circumcised by doctor	42	14.6
Had complications	23	8.0
Know that FGM is illegal	169	56.3
Believe FGM is mandated by religion	167	55.7
Have circumcised their daughters	232	77.3
Age at circumcision for daughter:		
Range	8-17	
Mean±SD	11.8±1.8	
Circumcised by doctor	62	26.7
Had complications	36	15.5

**Table 3. Attitude towards FGM among women in the study sample (n=300)**

	Agree	
	No.	%
FGM is a traditional practice that will continue	215	71.7
FGM is important to decrease sexual arousal	204	68.0
FGM helps to ease labor	155	51.7
FGM improves marital relations	157	52.3
FGM is a hygienic procedure for the girl	125	41.7
FGM is esthetic to decrease the size of the clitoris	115	38.3
FGM will continue for honor reasons	155	51.7
FGM is a good habit	193	64.3
FGM improves sexual relations	109	36.3
Encourage FGM for daughters	157	52.3
Husbands approve FGM	228	76.0
FGM should not be illegalized	189	63.0
Total attitude:		
Positive (discouraging)	92	30.7
Negative (encouraging)	208	69.3

**Table 4. Best fitting multiple linear regression model for positive (discouraging) attitude score towards FGM**

	Unstandardized Coefficients		Standardized Coefficients	T	p-value	95% Confidence limits for B	
	B	SE				Lower	Upper
Constant	48.85	6.80		7.187	<0.001	35.48	62.23
Education (reference: illiterate)	6.69	0.79	0.438	8.476	<0.001	5.14	8.25
Has been circumcised	-19.56	5.99	-0.169	3.265	0.001	-31.35	-7.77

r-square=0.26

Model ANOVA: F=51.90, p&lt;0.001

Variable excluded from model: age, religion, residence

**Table 5. Logistic regression model for daughter circumcision**

	Odds Ratio (OR)	p-value	95.0% C.I. for OR	
			Lower	Upper
Constant	3.239	0.341		
Age	1.098	<0.001	1.051	1.147
Education (reference: illiterate)	.375	<0.001	.245	.574
Positive attitude score	.256	0.002	.109	.598
FGM has religious basis	4.928	<0.001	2.107	11.530

Nagelkerke R Square=0.558, overall classification: 87.1%

Model ANOVA: F=123.60, p&lt;0.001

Variable excluded from model: religion, residence, age at circumcision, know FGM is illegal

#### 4. Discussion and conclusion

The study was aimed to assess the awareness and attitudes of a sample of Upper Egypt women towards FGM. The results indicated a very high prevalence of this practice, as well as a high percentage of encouraging attitudes which were related to the education of women and their being circumcised. Also the determinants of getting daughters circumcised were older age, religious belief, lower education, and encouraging attitude. These findings point to important factors that must be considered in the efforts addressing this major health problem.

According to the present study, almost all women included in the sample were circumcised. Although this finding is deceiving, it is expected since the minimal age in the sample (18 years) is older than the time of the first decree forbidding the practice in 1995. Therefore, the rate of FGM is expected to be high in this cohort. Our results are in congruence with those reported in a city of Upper Egypt, Luxor<sup>(10)</sup>, which is further to the South of the site of the present study. The percentage of circumcised women was 99.3%, compared to 95.7% in our study. Our slightly lower figure may be explained by the time difference as well as the setting, as the present study setting is much closer to the capital, which may have a positive influence on its socio-cultural environment.

What is more important than the high proportion of circumcision of women in our sample is the proportion among their daughters, reaching more than three-fourth of them. This is almost double of that reported in Ethiopia (42.4%), compared to 77.3% in our sample<sup>(16)</sup>. Although the proportion is lower in daughters, it is still high in view of the laws and decrees that date more than 15 years. It is also noticed that more than half of the women knew that FGM was illegal, but still practiced it. This shows that the laws alone are not sufficient to eradicate this habit. In this regard, *Aigbodion et al*<sup>(17)</sup> mentioned that this culturally patterned habit is handed from past generation and from parents to children. So, whatever the parents' attitudes and behaviors may be, they are adopted by their children.

Moreover, it seems that the laws forbidding FGM led to changes in the patterns of the practice. Thus, the minimal age shifted from five to eight years, with more physicians practicing it, and more associated complications. The age shift could be related to the more difficulty of finding a practitioner due to fear of sanctions. The higher complication rate might be attributed to lack of training of physicians in this procedure, which is not taught as a standard procedure in medical practice. It also might be related to the untoward non-standard conditions of the

settings in which they are practiced for fear of criminal accusation.

The present study demonstrated a generally encouraging attitude towards FGM. The attitudes reflected underlying reasons related to tradition, chastity, and honor as previously reported in similar studies<sup>(4,18,19)</sup>. However, the most agreed upon statement was that FGM was a demand of husbands or potential husbands. Therefore, women may feel themselves forced to perform it to their daughters on the grounds that it will ensure better chances for them daughters to get married in a society where FGM is deeply rooted and related to honor and men's desires. Such better marriage prospects were reported in the Egyptian Interim Demographic and Health Survey<sup>(20)</sup>.

According to the study findings, women' encouraging attitude was related to a number of factors. However, in multivariate analysis, only education and having been circumcised were the statistically significant independent predictors of the attitude score. Therefore, it is education that should be the long-term target that will lead to a change in the attitudes of women regarding FGM. Hence, the health education efforts should currently be focused on illiterate women, and those with low socio-economic conditions.

In line with these findings, studies in Egypt demonstrated that the majority of well educated women, as medical students, were against FGM<sup>(11, 21)</sup>. On the other hand, a study in Nigeria showed that lower educational background was associated with more favorable attitudes to FGM<sup>(17)</sup>. Moreover, a study in Nigeria<sup>(22)</sup> showed that only educational qualification contributed significantly to the prediction of women's attitude towards FGM.

The present study has also identified the factors associated with women's practice of circumcision of their daughters. Logistic regression revealed that older age and religious belief were positive predictors, while education and positive attitude score were negative predictors. The older age is expected since older women may be more compliant to the traditions of parents, and in their era, circumcision was not a forbidden or even a debatable issue. The finding is in agreement with *Afifi*<sup>(14)</sup> who reported that young age was associated with the intention to discontinue the practice. As for education, it is evident that it can shape the attitude, and consequently the behavior, which is in congruence with previous studies<sup>(23, 24)</sup>.

The last and most important factor is thus the religious belief. It is noteworthy that it is the religious belief and not the religion that determines the decision since no differences were revealed between Moslem and Christian women. Although studies have cited the importance of religion as the



major driving forces behind the practice of FGM<sup>(25, 26)</sup>, there is no religious scriptural evidence supporting it<sup>(27)</sup>. In fact, FGM was practiced before Islam and Christianity<sup>(18)</sup>. However, it is difficult or even impossible to disentangle religious from cultural and social beliefs, and people try to relate the milder forms of FGM with Islamic religion<sup>(4, 25)</sup>.

The study findings lead to the conclusion that FGM is still an important and culturally sensitive issue in Upper Egypt community, and most women encourage it mainly on religious grounds. Also, illiteracy is a risk factor for perpetuation of this habit. Therefore, health education efforts should be focused on those women with lower educational levels, and these programs should be supported by religious scholars who must convince people that this habit is not mandated by religion. They should also be addressed to older women who advocate the habit and are usually in a decision-making position in its practice.

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# Effect of Acidifiers on Gastrointestinal Tract Integrity, Zootechnical Performance and Colonization of *Clostridium Perfringens* and Aerobic Bacteria in Broiler Chickens

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**Abstract:** This experiment was to investigate the effect of acidifiers (Protected organic acidifier, CAPacid<sup>®</sup>, Neovia, France) on gastrointestinal tract (GIT) integrity, zootechnical performance and colonization of *Clostridium perfringens* (*C. perfringens*) (type C) and aerobic bacteria in broilers from 1 to 42 days of age under commercial conditions. Obtained results clarified that broiler diets supplemented with acidifier could improve chicken performance ( $P < 0.05$ ). Also, it decreased the mortality rate, intestinal and cecal colonization of both *C. perfringens* (naturally present or experimentally induced) and the total aerobic bacteria. The macroscopic and microscopic lesion scores associated with *C. perfringens* infection were also decreased ( $P < 0.05$ ). The current study has shown the interest of using protected organic acidifiers into the feed of broiler chickens submitted to *C. perfringens* infection. In addition, taking in consideration the facts that organic acids do not require withdrawal period, that bird performance are positively affected by their use and that they increase the shelf-life of products, they can make a valuable contribution to flock health and safety of poultry products as food. This may provide a significant tool for the poultry industry in combating the occurrence of intestinal diseases and in reduction of food borne pathogens. [M.H.H. Awaad, A.M. Atta, M. Elmenawey, B. Shalaby, G.A. Abdelaleem, K. Madian, K. Ahmed, D. Marzin, G. Benzoni and D.K. Iskander. **S Effect of Acidifiers on Gastrointestinal Tract Integrity, Zootechnical Performance and Colonization of *Clostridium Perfringens* and Aerobic Bacteria in Broiler Chickens**. Journal of American Science 2011;7(4):618-628]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Key words:** Chickens, Acidifier, *Clostridium perfringens*, Aerobic bacteria, gastrointestinal tract integrity.

## 1. Introduction:

Microbial imbalance has a deteriorating effect on GIT integrity. The later is a major challenge facing poultry industry specially after banning the sub-therapeutic use of antibiotics growth promoters in 2006. Consequently, feed formulators need efficient alternatives to use as commodities. Natural alternatives concepts based on natural ingredients for GIT integrity and antibacterial action are highly commendable. Lückstädt (2003) mentioned under this point of view that acidifiers can be part of the feeding concept to fill the gap from the antibiotics and to replace antibiotic growth promoters. Because of their pH-reducing and antimicrobial effects, acidifiers appear as one of the most feasible and functional alternative to antibiotics growth promoters. Accordingly, experts in the poultry industry have given the use of acidifiers closer scrutiny. The auspicious effect of acidifiers over the organism is due to the better adhesion of the lactic acid bacteria to the intestinal epithelium in comparison with the pathogenic bacteria, and stooping the implementation

of those bacteria over the mucus membranes of the intestine.

Among these micro-organisms, *C. perfringens* is an obligate anaerobic bacterium in the intestinal tract of chickens (Johansson and Sarles, 1948; and Shapiro and Sarles, 1949). This organism is relatively innocuous unless cofactors occur such as undigestible dietary ingredients or diet rapid changes, severe stress, coccidiosis, or immunosuppressive affections (Barnes, 1997). The bacterium's pathogenicity is largely derived from its prolific ability to express protein toxins that are active in the GIT (McClane, 2001). Alpha toxin produced by *C. perfringens* types A and C, and beta toxin produced by *C. perfringens* type C, are those believed responsible for necrotic enteritis which is a common problem among rapidly growing broiler strains of chickens that are raised intensively in modern microenvironments (Kohler et al., 1974 and Hofarce, 1998), and that threatens GIT health and livability of many poultry flocks (Craven et al., 2001). *C. perfringens* may cause damage to the intestinal tract,

leading to poor feed efficiency, decreased rate of gain and increased production costs. On the other hand, *C. perfringens* is responsible for severe food borne enteritis in man and its enterotoxin has been shown to be responsible for food poisoning (Brynstad, 2002). The presence of *C. perfringens* in food such as meat or poultry may be unavoidable (Ghadban et al., 1998).

The potential advantage of organic acids in the feed of poultry has been proven and well documented for decades. However, new trials are still necessary to establish performance results under different production conditions. The purpose of this study is to adopt by both subjective and objective criteria a semi-field trial in an attempt to investigate the effect of a protected acidifier compound (CAPacid®, Neovia) in reducing intestinal and cecal colonization with *C. perfringens* type C and total aerobic bacteria as well as its effect on the zootechnical performance of broiler chickens.

## 2. Material and Methods

### Experimental design

Day old Arbor Acres Plus chicks (n=900) were used in this semi-field trial study. These birds were allotted into 4 equal groups (1-4) of 225 birds assigned into 3 replicates of 75 each. Chicks from group 1 were not infected with *C. perfringens* and received CAPacid® in the feed. Chicks from group 2 were not infected with *C. perfringens* and received control feed without CAPacid®. Chicks from group 3 were infected with *C. perfringens* and received CAPacid® in the feed. Chicks from group 4 were infected with *C. perfringens* and received the control

feed without treatment. Chicks were floor reared in pens and kept in environmentally controlled rooms. Chicks of all groups were vaccinated against Newcastle disease and infectious bronchitis using Hitchner B1+ H120 vaccines at 7<sup>th</sup> day of age and against Avian Influenza at 10<sup>th</sup> day of age using H5N2 vaccine. Revaccination against Newcastle disease using La Sota vaccine and vaccination against infectious bursal disease using 228-E IBDV vaccine were given at 14<sup>th</sup> day of age. Avian influenza vaccine was given subcutaneously while other vaccines were administered via drinking water. At 21 d of age, 10 chickens from the 3 replicates of groups 3 and 4 (30 birds / each) were subcutaneously inoculated with  $0.5 \times 10^8$  CFU / bird of *C. perfringens* in phosphate buffered saline (PBS) according to Awaad et al. (2005).

### Feeding

Chickens were fed commercial starter ration (23% C.P. and 12'552 kJ/kg ME/kg diet) during the first 3 wk of age, and then commercial finisher ration (19% C.P. and 13'388.8 kJ/kg ME/kg diet) for the final 3 w. The diet compositions are indicated in (Table 1). The ration (mash) was given with the acidifier CAPacid® (Neovia) in a dose of 750 g / T and 250 g / T in starter and finisher rations only for the treated broiler chicken groups respectively. Those untreated groups were fed on a plain ration. During the entire experiment, feed and water were provided with *ad libitum* consumption. Diclazuril (Clinacox) was added as a coccidiostate. No antibiotics were added to the ration.

**Table 1. Ingredient percentage and calculated analysis of broiler diets**

	Starter	Finisher
<b>Ingredients (%)</b>		
Yellow corn	52.45	62.85
Soybean meal 44%	33.24	22.11
Corn gluten meal 60%	7.00	6.65
Oil	3.00	4.00
Di-calcium phosphate	1.80	1.80
Lime stone	1.30	1.30
DL-Methionine	0.22	0.23
Lysine hydrochloride	0.29	0.36
Sodium chloride	0.40	0.40
Premix <sup>1</sup>	0.30	0.30
<b>Calculated composition</b>		
Crude protein (%)	23.00	19.00
Metabolizable energy (kJ/kg)	12'552.00	13'388.80

<sup>1</sup>Each gram of mineral mixture contained: vitamin A (trans-retinyl acetate), 9,000 IU; vitamin D3 (cholecalciferol), 2,600 IU; vitamin E (dl- $\alpha$ -tocopheryl acetate), 16 mg; vitamin B1, 1.6 mg; vitamin B2, 6.5 mg; vitamin B6, 2.2 mg; vitamin B12 (cyanocobalamin), 0.015 mg; vitamin K3, 2.5mg; choline (choline chloride), 300 mg; nicotinic acid, 30 mg; pantothenic acid (d-calcium pantothenate), 10 mg; folic acid, 0.6 mg; d-biotin, 0.07 mg; manganese (MnO), 70 mg; zinc (ZnO), 60 mg; iron (FeSO4 H<sub>2</sub>O), 40 mg; copper (CuSO<sub>4</sub> 5H<sub>2</sub>O), 7 mg; iodine [Ca(IO<sub>3</sub>)<sub>2</sub>], 0.7 mg; selenium (Na<sub>2</sub>SeO<sub>3</sub>), 0.3 mg..

**Measured parameters:****1. Zootechnical performance:**

Chicken performance response variables were determined according to Brady (1968), Sainsbury (1984) and North (1984); Body weight (wt.) and wt. gain were measured on all animals. Feed consumption (g / d / bird), feed conversion ratio (FCR) (g feed / g live body wt.) and carcass characteristics (live body wt., carcass wt., dressing (%), front part {wt. (g) and %}, hind part {wt. (g) and %}, liver wt., heart wt., gizzard wt. and intestine (length and diameter) were measured on birds of groups 1 and 2. For body wt. all birds were weighed individually at 1 d and at 6 wk of age. Feed consumption was measured on the same days of birds weighting.

**2. Bioassay:**

Intestinal and cecal colonization of *C. perfringens* and total aerobic bacteria were evaluated at 0, 3, 7, 14 and 21 d post infection (PI). Four birds were sacrificed at each date in each pen (12 birds per treatment and per date, 60 birds per treatment for the whole trial, and 240 birds for the whole trial). For colonization of *C. perfringens* from each bird, a portion of the intestinal and cecal contents (0.2 g) were serially diluted in sterile PBS to 1:100, 1:1000, or 1:10000 and 0.1 ml of each dilution and were poured on the surface of sheep blood agar plates and tryptose sulfite-cycloserine (TSC) agar (supplemented by D-cycloserine) with egg yolk emulsion. This was overlaid with the same medium but without egg yolk. After anaerobic incubation at 37°C for 24 hours, typical *C. perfringens* colonies (black colonies) on TSC agar or large dom-shaped colonies with a double zone of hemolysis on blood agar plate, were counted and reported as colony-forming units (CFU) per gram and picked and confirmed by criteria of Harmon (1984) and Carrido et al. (2004). For total aerobic bacterial colonization,  $10^{-1}$  to  $10^{-8}$  serial dilutions were made of intestinal and cecal contents (0.2 g) in sterile PBS from each bird and 0.1 ml of each dilution was plated onto blood agar plate and nutrient agar. The plates were incubated aerobically at 37°C for 24 hours and colonies were counted and calculated per gram.

**3. Histopathological assay:**

Specimens including liver and intestine were randomly collected from sacrificed chickens at 3, 7, 14 and 21 d PI, fixed in 15% buffered formalin. Paraffin-embedded sections were routinely prepared and stained with Hematoxylin and Eosin (Bancroft et al., 1996), and scored for histopathological lesions according to the method described by Rosales et al. (1989).

**Statistical analysis:**

Weights and body weight gains were subjected to analysis of variance in a complete design with infection and CAPcid treatment as fixed factors. If significant differences were observed, the mean of groups were compared using Duncan mean test comparison. Other data were treated according to Snedecor (1956) and Cochran and Cox (1960).

**3. Results and Discussion**

Global potential for animal feed acidifiers and other health products for animals are on rise due to the higher need for top quality poultry. Stable demand from developed countries for meat coupled with escalating consumption in the developing world, improving living standards, and swelling of population are expected to propel the worldwide demand for animal feed additives. On the other hand, food safety is probably the biggest issue facing poultry production systems today. Consumer confidence has a direct correlation to the safety and wholesomeness of the product they will purchase. Preventing contamination of poultry products with food borne pathogens remains a considerable challenge for producers and integrations. One of these food borne pathogens is *C. perfringens* which is responsible for the rare but severe food borne necrotic enteritis in man (enteritis necroticans or pig-bel disease) which is fatal specially in young and elderly and its enterotoxin has been shown to be the virulence factor responsible for causing the symptoms of *C. perfringens* type A food poisoning which is the more common in the industrialized world (Ghadban et al., 1998 and Brynestad, 2002). Hence the widespread use of antibiotics as therapeutic agents and growth promoters result in the development of resistant population of bacteria which made their subsequent use for therapy difficult and result in occurrence of antibiotic residues in the poultry products (DuPont and Steele, 1987); the direction towards the use of environmentally friendly alternatives as natural control method has been emerged. To reduce the risk factors associated with enteropathogens, the industry has installed programs to reduce their incidence. One of these programs is addition of feed acidifiers which has contributed immensely to the minimization of the pathogens.

In the present semi-field trial, the zootechnical performance variables in naturally induced *C. perfringens* chickens showed significant improvement in CAPacid® treated group over the non-treated control group. Regardless statistical analysis, FCR was lower in CAPacid® treated group over the control one at all examined times (Table 3). Statistically significant increase was recorded in



**Table 3.** Performance of non infected birds (n=200)

	Body weight (g)						
	0 wk	1 wk	2 wk	3 wk	4 wk	5 wk	6 wk
Non infected Control	43± 2.9	138± 8.8	324± 9.4	636± 112.5	1007± 157.2	1528± 173.5	2009± 196.7
Infected CAPacid	43±1.8	133±17.5	343±53.9	663± 103.6	1072± 163.8	1581± 194.5	2055± 226.9
Significance	NS	< 0.01 **	< 0.01 **	< 0.05 *	< 0.001 ***	< 0.01 **	< 0.1
	Body weight gain (g)						
	0 – 1 wk	1 – 2 wk	2 – 3 wk	3-4 wk	4 -5 wk	5 – 6 wk	0 – 6 wk
Non infected Control	95 ± 18.2	187± 1.9	310± 82.7	376± 120.4	520± 138.0	472± 132.4	1966± 196.8
Infected CAPacid	90 ± 17.7	210± 6.4	319± 82.4	419± 136.8	504± 130.2	471± 134.8	2012± 227.0
Significance	< 0.01 **	0.001 ***	NS	< 0.01 **	NS	NS	< 0.05 *
	Feed consumption (g/d/bird)						
	1 wk	2 wk	3 wk	4 wk	5 wk	6 wk	
Non infected Control	21.49 <sup>a</sup> ± 0.04	48.46 <sup>b</sup> ± 0.68	89.26± 1.83	116.54± 3.59	162.94± 9.00	166.42± 1.45	
Infected CAPacid	19.69 <sup>b*</sup> ± 0.30	53.37 <sup>a</sup> ± 1.11	87.36± 1.12	119.53± 4.85	162.99± 8.60	170.21± 2.30	
Significance	< 0.001 ***	< 0.05 *	NS	NS	NS	NS	
	Feed conversion ratio (g feed : g live body weight)						
	1 wk	2 wk	3 wk	4 wk	5 wk	6 wk	Cumulative
Non infected Control	1.577± 0.027	1.840± 0.047	2.017± 0.057	2.207± 0.086	2.275± 0.135	2.538± 0.045	2.218± 0.049
Infected CAPacid	1.556± 0.028	1.793± 0.042	1.925± 0.045	2.149± 0.125	2.191± 0.105	2.556± 0.047	2.152± 0.049
Significance	NS	NS	NS	NS	NS	NS	NS
Carcass characteristics							
	Live body weight (g)	Carcass weight (g)	Dressing (%)	Front part weight		Hind part weight	
				(g)	(%)	(g)	(%)
Non infected control	1993.38±25.90	1438.00 <sup>b</sup> ±20.07	72.18±0.41	789.50 <sup>b</sup> ±11.81	39.62±0.28	647.88 <sup>b</sup> ±9.37	32.53±0.25
Infected CAPacid	2058.72±21.02	1502.31 <sup>a</sup> ±18.41	72.95±0.46	823.46 <sup>a</sup> ±10.47	39.99±0.30	678.85 <sup>a</sup> ±9.35	32.95±0.28
Significance	NS	< 0.05 *	NS	< 0.05 *	NS	< 0.05 *	NS
Carcass characteristics							
	Liver weight		Heart weight		Gizzard weight		Intestine (cm)
	(g)	(%)	(g)	(%)	(g)	(%)	Length Diameter
Non infected control	64.38 <sup>b</sup> ±1.39	3.208±0.061	9.63±0.26	0.487±0.014	51.75±1.45	2.590±0.062	198.25 <sup>b</sup> ±1.38 0.634 <sup>b</sup> ±0.007
Infected CAPacid	68.21 <sup>a*</sup> ±1.27	3.330±0.067	9.87±0.30	0.479±0.014	53.21±1.33	2.591±0.062	206.39 <sup>a</sup> ±1.78 0.667 <sup>a</sup> ±0.007
Significance	< 0.05 *	NS	NS	NS	NS	NS	< 0.05 * < 0.05 *

Means of each trait within age with different superscripts are significantly different (P 0.05).

CAPacid® treated group since 2 wk of age till end of the trial. Weight gain was significantly improved by CAPacid® during the periods 1 to 2 wk of age and 3 to 4 wk of age, and the global raising period. There was a significant interaction between the infection and the CAPacid® treatment on the final body wt.; CAPacid® tended to have a more positive effect on infected birds (+5.1%) than in non infected birds (+2.3%). The infected control chickens final wt. was significantly lower than that of non infected control birds whereas final wt. of infected birds treated with CAPacid® was not significantly different from the non infected birds final wt. (Tables 2 and 2 Bis). Vogt et al. (1981), Skinner et al. (1991) and Kirchgessner et al. (1991) reported on increase in broiler performance due to the use of single acids. Lückstädt et al. (2004) recorded that the final body wt. of the treated broiler chickens with an acidifier was significantly increased and other performance data showed better results, the average daily wt. gain was higher in the acidifier group, partly significantly and the FCR was slightly reduced, even if this reduction was not significantly. Our obtained results are in accordance with that reported by Versteegh and

Jonbloed (1999) who investigated the effect of lactic acid on the performance of broilers.

Non infected CAPacid® treated group showed a cumulative mortality rate reaching 2% as compared with 5% in non infected control group. On the other hand, during 3<sup>th</sup> and 6<sup>th</sup> experimental weeks, significant higher mortality rate was recorded in experimentally infected non-treated group over the treated one and the cumulative mortality rate in this acidifier treated group recorded a lower value than that of non-treated one (3% versus 5.5%) (Table4). Lückstädt et al. (2004) mentioned that feed industry and food production sector still suffer from huge losses due to the contamination of feed with pathogenic bacteria and their related impacts on the animal, such as lower wt. gains or even increased mortality. Kim et al. (2005) concluded that dietary acidifiers appear to be a possible alternative to feed antibiotics in order to improve performance of broilers. It is generally known that dietary acidifiers lower gastric pH, resulting in increased activity of proteolytic enzymes, improved protein digestibility and inhibiting the proliferation of pathogenic bacteria in GIT.

**Table 2.** Birds weights (n=200)

	0 wk	1 wk	2 wk	3 wk	4 wk	5 wk	6 wk
Non infected Control	43 ± 2.9	138 ± 18.8	324 ± 59.4	636 ± 112.5	1007 ± 157.2	1528 ± 173.5	2009 <sup>a</sup> ± 196.7
Non Infected CAPacid	43 ± 1.8	133 ± 17.5	343 ± 53.9	663 ± 103.6	1072 ± 163.8	1581 ± 194.5	2055 <sup>a</sup> ± 226.9
Infected Control	43 ± 2.8	139 ± 20.5	323 ± 59.5	633 ± 127.6	985 ± 181.7	1493 ± 239.3	1924 <sup>b</sup> ± 240.4
Infected CAPacid	43 ± 3.7	131 ± 18.4	338 ± 52.4	661 ± 69.5	1011 ± 124.7	1548 ± 164.3	2023 <sup>a</sup> ± 183.4
<i>Infection x Tmt</i>	NS	NS	NS	NS	< 0.1	NS	< 0.1
Non infected	43 ± 2.4	135 ± 18.3	333 ± 57.4	649 ± 108.8	1039 ± 163.7	1554 ± 185.8	2032 ± 213.6
Infected	43 ± 3.3	135 ± 19.8	331 ± 56.5	647 ± 104.2	997 ± 157.6	1520 ± 208.2	1970 ± 221.0
<i>Infection</i>	NS	NS	NS	NS	< 0.001 ***	< 0.05 *	< 0.001 ***
Control	43 ± 2.9	139 ± 19.6	324 ± 59.4	635 ± 120.3	997 ± 168.4	1513 ± 204.8	1970 ± 221.6
CAPacid	43 ± 2.9	132 ± 17.9	340 ± 53.1	662 ± 88.2	1047 ± 151.7	1567 ± 183.0	2042 ± 210.3
<i>Treatment</i>	NS	<0.001 ***	<0.001 ***	< 0.001 ***	< 0.001 ***	< 0.001 ***	< 0.001 ***

NS: Not significant ((P ≥ 0.05).

**Table 2 Cont. Birds weight gains (n=200)**

	0-1 wk	1-2 wk	2-3 wk	3-4 wk	4-5 wk	5-6 wk	0-6 wk
Non infected	95	187	310	376	520	472	1966
Control	± 18.2	± 51.9	± 82.7	± 120.4	± 138.0	± 132.4	± 196.8
Non Infected	90	210	319	419	504	471	2012
CAPacid	± 17.7	± 46.4	± 82.4	± 136.8	± 130.2	± 134.8	± 227.0
Infected	97	184	310	375	508	447	1882
Control	± 20.0	± 50.6	± 90.7	± 131.9	± 159.7	± 131.5	± 240.6
Infected	88	207	320	373	535	463	1979
CAPacid	± 18.5	± 47.1	± 62.8	± 118.3	± 132.8	± 132.1	± 183.2
<i>Infection x Tmt</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	< 0.05 *	< 0.1	<i>NS</i>	<i>NS</i>
Non infected	92	198	315	398	512	472	1989
	± 18.1	± 50.6	± 82.5	± 130.6	± 134.2	± 133.4	± 213.6
Infected	92	195	315	374	521	454	1927
	± 19.7	± 50.2	± 78.4	± 125.4	± 147.8	± 131.7	± 221.0
<i>Infection</i>	<i>NS</i>	<i>NS</i>	<i>NS</i>	< 0.05 *	<i>NS</i>	<i>NS</i>	< 0.001 ***
Control	96	185	310	375	515	461	1927
	± 19.1	± 51.2	± 86.8	± 125.5	± 147.8	± 132.4	± 221.7
CAPacid	89	209	320	400	517	468	1999
	± 18.1	± 46.7	± 73.3	± 131.3	± 132.0	± 133.5	± 210.3
<i>Treatment</i>	< 0.001 ***	< 0.001 ***	<i>NS</i>	< 0.05 *	<i>NS</i>	<i>NS</i>	< 0.001 ***

*NS*: Not significant ((P ≥ 0.05).

**Table 4. Mortality rate (%)**

Groups	Age (wk)						Cumulative
	1	2	3	4	5	6	
Non infected	0.50	2.00	0.00 <sup>b</sup>	0.50	1.50	0.50 <sup>ab</sup>	5.00
Control	± 0.50	± 0.82	± 0.00	± 0.50	± 0.96	± 0.50	± 1.29
Non infected	0.00	0.50	0.00 <sup>b</sup>	0.50	0.50	0.50 <sup>ab</sup>	2.00
CAPacid	± 0.00	± 0.50	± 0.00	± 0.50	± 0.50	± 0.50	± 1.41
Infected Control	0.00	0.50	0.00 <sup>b</sup>	0.50	2.50	2.00 <sup>a</sup>	5.50
	± 0.00	± 0.50	± 0.00	± 0.50	± 0.96	± 0.82	± 2.22
Infected CAPacid	0.50	1.00	1.00 <sup>a</sup>	0.00	0.50	0.00 <sup>b</sup>	3.00
	± 0.50	± 0.58	± 0.58	± 0.00	± 0.50	± 0.00	± 0.58

Means with different, superscripts, within column, are significantly different (P = 0.05).

They also hypothesized that acidifiers could be related to reduction of gastric emptying rate, energy source in intestine, chelating minerals, stimulation of digestive enzymes and intermediate metabolism. Dhawale (2005) mentioned that the profile of intestinal microflora plays an important role in gut health and in healthy birds, there is a balance between the Gram-positive and Gram-negative populations of microflora at an ideal pH. He added that a disease condition results when there is a shift towards the enteropathogenic population. Thus, maintenance of the ideal pH for microbial balance is essential for keeping the gut healthy. The use of gut acidifiers has been proven to be of immense help in maintaining the microbial balance of the gut. The mode of action of the acidifier in relation to zootechnical performance can be summarized in that they maintain an optimum pH in the stomach, allowing correct activation and function of proteolytic enzymes, optimise protein digestion in stomach, stimulate feed consumption by improving palatability of feed, inhibit the growth of pathogenic bacteria, yeasts and moulds, improve protein and energy digestibilities by reducing microbial competition with the host for nutrients, as well as endogenous nitrogen losses, lower the incidence of sub-clinical infections, reduce the production of ammonia and other growth-depressing microbial metabolites, increase pancreatic secretion and tropic effects on gastrointestinal mucosa and favour mineral absorption by creating an ideal pH in the intestine.

Bacteriological results of *C. perfringens* colonization as well as total aerobic bacteria colonization in CAPacid® treated groups have clearly showed that using acidifiers is considered a novel and effective alternatives to antibiotics that could reduce the severity of *C. perfringens*-associated necrotic enteritis challenge in broilers. As the cecum is also a main site of *C. perfringens* the effect of the studied acidifier was adopted for cecal colonization of *C. perfringens* where reduction in its count significantly occurred during the entire period of the experiment (42d) on using CAPacid®. It seems that the use of this acidifier can greatly assist in the control of both *C. perfringens* and total aerobic bacteria colonization in broilers (Tables 5-8). Results of bacteriological examination could be explained in the view of the report of Dhawale (2005) who mentioned that organic acids in undissociated state (non-ionised) are more lipophilic, penetrate the semi-permeable membrane of the bacterial cell wall and enter the cytoplasm. He also added that at the internal pH of bacteria (around pH 7.0), the organic acids dissociate, releasing hydrogen ions ( $H^+$ ) and anions ( $A^-$ ). The internal pH of the microbe decreases, which the bacteria are unable to tolerate.

A specific  $H^+$ -ATPase pump acts to bring the pH inside the bacteria level. This phenomenon consumes energy and eventually stops the growth of the bacteria or even kills them. The lowering of pH also suppresses the enzymes, e.g. decarboxylases and catalyses, inhibits glycolysis, prevents active transport and interferes with signal transduction. The anionic ( $A^-$ ) part of the acid is trapped inside the bacteria and becomes toxic by creating anionic osmotic problems for the bacteria. He concluded that the antibacterial effects of organic acids work through: modification of internal pH; inhibition of fundamental metabolic functions; accumulation of toxic anions and disruption of the cellular membrane.

No histopathological changes could be detected in liver or intestine of either treated or non-treated naturally induced *C. perfringens* groups (Fig. 1; Images 6 and 10). In experimentally infected broiler chickens the livers of non-treated group examined sections revealed Kupffer cells activation, vacuolar degeneration of hepatocytes and perivascular leucocytic cells aggregation mainly heterophils (Fig. 1; Image 1). These histopathological alterations were observed at 3 d PI (1st sample), whereas, at 7 d PI (2nd sample), examined liver showed vacuolar degeneration of hepatocytes, hyperplasia and focal desquamation of epithelial lining bile duct (Fig. 1; Image 2) associated with massive leucocytic cells infiltration in the portal triad (Fig. 1; Image 3) and focal areas of hepatic necrosis. Moreover, at 14 and 21 d PI (3rd and 4th samples), liver of chickens from this group revealed vacuolar degeneration of hepatocytes, perivascular infiltration with heterophils (Fig. 1; Image 4) as well as focal hepatic necrosis. Experimentally *C. perfringens* infected treated group showed no histopathological changes all over the experimental period recorded except vacuolar degeneration of hepatocytes (Fig. 1; Image 5).

Examination of intestinal sections of *C. perfringens* infected non-treated group revealed severe histopathological alterations at 14 and 21 d PI, those alterations described as marked caseous necrosis of intestinal mucosa (Fig. 1; Image 7), activation of mucous secreting cells in lamina epithelialis and marked leucocytic cells infiltrations in lamina propria (mainly heterophils) (Fig. 1; Image 8). While, the infected and CAPacid® treated group showed no histopathological changes all over the experimental period except vacuolar degeneration of hepatocytes of liver and slight edema in lamina propria of intestine (Fig. 1; Image 9). At 14 and 21 d PI, examined sections from this group revealed no histopathological changes. Aforementioned results are assuming that CAPacid® could sustain the GIT integrity damaged by *C. perfringens* infection.



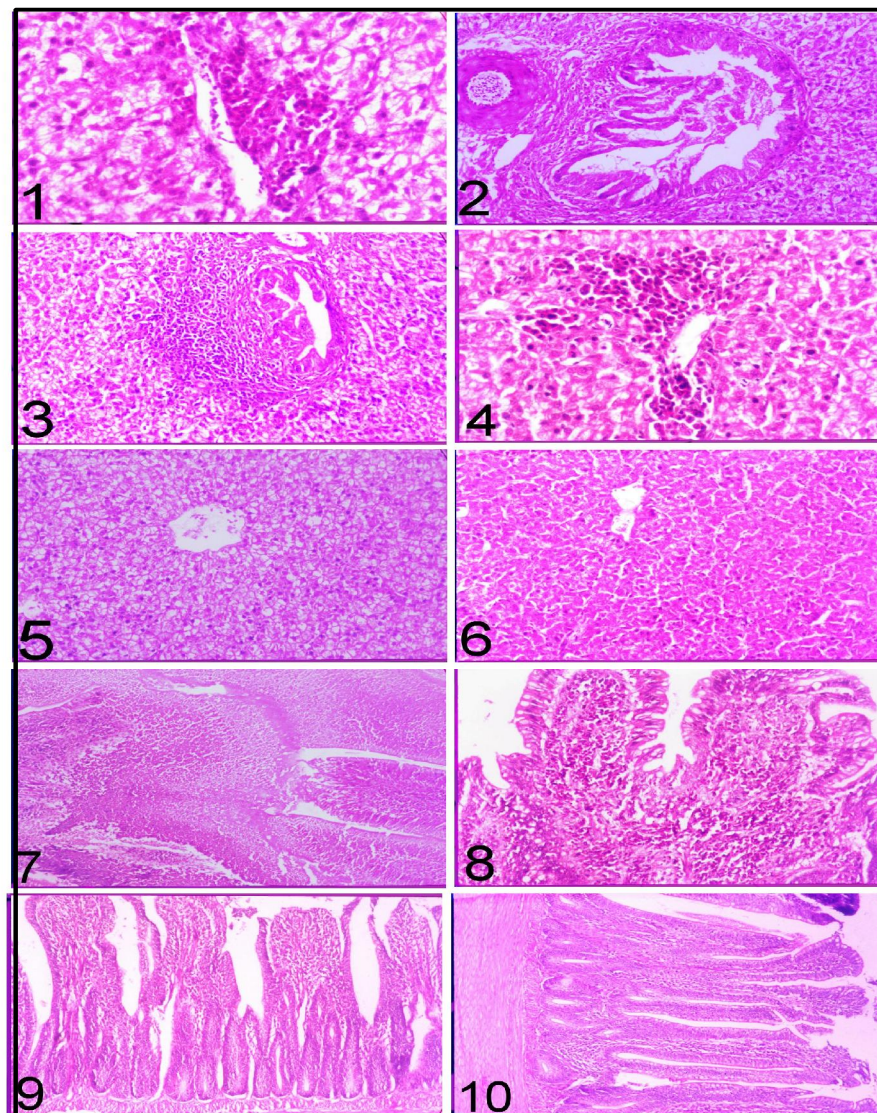


Fig. (1): Image 1: Liver of non-treated broiler chickens 3 d post experimental infection with *C. perfringens* (1<sup>st</sup> sample PI) showing vacuolar degeneration of hepatocytes and perivascular leucocytic cells aggregation. H & E X 400; Image 2: Liver of non-treated broiler chickens 7 d post experimental infection with *C. perfringens* (2<sup>nd</sup> sample PI) showing vacuolar degeneration of hepatocytes, hyperplasia and focal desquamation of epithelial lining bile duct. H & E X 200; Image 3: Liver of non-treated broiler chickens 7 d post experimental infection with *C. perfringens* (2<sup>nd</sup> sample PI) showing vacuolar degeneration of hepatocytes associated with massive leucocytic cells infiltration in the portal triad. H & E X 200; Image 4: Liver of non-treated broiler chickens 14 and 21 d post experimental infection with *C. perfringens* (3<sup>rd</sup> and 4<sup>th</sup> samples PI) showing vacuolar degeneration of hepatocytes and perivascular infiltration with heterophils and focal hepatic necrosis. H & E X 400; Image 5: Liver of CAPacid treated broiler chickens 14 d post experimental infection with *C. perfringens* (3<sup>rd</sup> sample PI) showing vacuolar degeneration of hepatocytes. H & E X 200; Image 6: Liver of CAPacid treated and non-treated non-infected broiler chickens showing no histopathological changes. H & E X 200; Image 7: Intestine of non-treated broiler chickens 21 d post experimental infection with *C. perfringens* (4<sup>th</sup> sample PI) showing marked caseous necrosis of intestinal mucosa. H & E X 200; Image 8: Intestine of non-treated broiler chickens 14 d post experimental infection with *C. perfringens* (3<sup>rd</sup> sample PI) showing marked leucocytic cells infiltration in lamina propria. H & E X 200; Image 9: Intestine of CAPacid treated broiler chickens 14 d post experimental infection with *C. perfringens* (3<sup>rd</sup> sample PI) showing slight edema in lamina propria. H & E X 100; Image 10: Intestine of treated and non-treated non-infected broiler chickens showing no histopathological changes. H & E X 100.



In conclusion the current study has shown the interest of using protected organic acidifiers in broiler diets to struggle *C. perfringens* infection. In addition, taking in consideration the facts that organic acids do not require withdrawal period, that bird performance are positively affected by their use and that they increase the shelf-life of products, they can make a valuable contribution to flock health and safety of poultry products as food. This may provide a significant tool for the poultry industry in combating the occurrence of intestinal diseases and in reduction of food borne pathogens.

**Table 5.** Means of *C. perfringens* colonization in experimentally infected broiler chickens ( $10^3$  CFU / g)

Time Post Infection	Intestine		Cecum	
	Treated	Non-treated	Treated	Non-treated
0 hr	0.142 <sup>b</sup> ±0.045	212.000 <sup>a</sup> ± 38.727	0.440 <sup>b</sup> ± 0.050	754.000 <sup>a</sup> ± 143.149
3 d	3.020 <sup>b</sup> ±0.693	2600.000 <sup>a</sup> ±339.935	2.982 <sup>b</sup> ± 1.107	9000.000 <sup>a</sup> ±1173.790
7 d	0.420 <sup>b</sup> ±0.049	568.000 <sup>a</sup> ± 35.428	0.760 <sup>b</sup> ± 0.081	5000.000 <sup>a</sup> ±964.019
14d	5.000 <sup>b</sup> ±0.471	236.000 <sup>a</sup> ± 13.920	8.800 <sup>b</sup> ± 0.490	394.000 <sup>a</sup> ± 23.247

Means within time and within region of GIT with different, superscripts are significantly different (P 0.05).

**Table 6.** Means of naturally induced *C. perfringens* ( $10^3$  CFU / g)

Age	Intestine		Caecum	
	Treated	Non-treated	Treated	Non-treated
21 d	0.142 <sup>b</sup> ± 0.045	212.000 <sup>a</sup> ±38.727	0.440 <sup>b</sup> ± 0.050	754.000 <sup>a</sup> ±143.149
24 d	0.360 <sup>b</sup> ± 0.069	298.000 <sup>a</sup> ±29.469	0.680 <sup>b</sup> ± 0.061	1020.000 <sup>a</sup> ±106.249
28 d	0.700 <sup>b</sup> ±0.037	232.000 <sup>a</sup> ±16.918	1.040 <sup>b</sup> ±0.027	450.000 <sup>a</sup> ±60.663
35 d	1.500 <sup>b</sup> ±0.099	34.620 <sup>a</sup> ±7.770	2.380 <sup>b</sup> ±0.294	66.780 <sup>a</sup> ±11.942

Means within time and within region of GIT with different, superscripts are significantly different (P 0.05).

**Table 7.** Means of Total aerobic bacteria colonization in experimentally infected broiler chickens with *C. perfringens* ( $10^3$  CFU / g)

Time Post Infection	Intestine		Cecum	
	Treated	Non-treated	Treated	Non-treated
0 h	1.425 <sup>b</sup> ±0.354	3420.000 <sup>a</sup> ±803.990	4.325 <sup>b</sup> ±0.768	1600.000 <sup>a</sup> ±266.667
3 d	1.780 <sup>b</sup> ±0.191	5760.000 <sup>a</sup> ±946.948	12.200 <sup>b</sup> ±6.301	10040.000 <sup>a</sup> ±1373.010
7 d	4.200 <sup>b</sup> ±0.646	1420.000 <sup>a</sup> ±121.838	8.800 <sup>b</sup> ±0.442	1660.000 <sup>a</sup> ± 125.786
14 d	9.000 <sup>b</sup> ±1.011	2330.000 <sup>a</sup> ±388.387	14.000 <sup>b</sup> ±1.265	2326.000 <sup>a</sup> ± 570.480

Means within time and within region of GIT with different, superscripts are significantly different (P 0.05).

**Table 8.** Means of Total aerobic bacteria naturally induced colonization ( $10^3$  CFU / g)

Age	Intestine		Cecum	
	Treated	Non-treated	Treated	Non-treated
21 d	1.425 <sup>b</sup> ±0.354	3420.000 <sup>a</sup> ±803.990	4.325 <sup>b</sup> ±0.768	1600.000 <sup>a</sup> ±266.667
24 d	0.152 <sup>b</sup> ±0.013	5400.000 <sup>a</sup> ±805.536	0.244 <sup>b</sup> ±0.031	12400.000 <sup>a</sup> ±1002.220
28 d	2.780 <sup>b</sup> ±0.071	1740.000 <sup>a</sup> ±212.498	3.400 <sup>b</sup> ±0.137	2780.000 <sup>a</sup> ±359.877
35 d	4.140 <sup>b</sup> ±0.224	194.000 <sup>a</sup> ±16.138	4.580 <sup>b</sup> ±0.122	270.000 <sup>a</sup> ±25.734

Means within time and within region of GIT with different, superscripts are significantly different (P = 0.05).

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**Design of optimal fuzzy controller for water level of U-Tube steam generator in nuclear power station**Hamdi. M. Mousa<sup>\*</sup>, Magdy. A. Koutb<sup>\*\*</sup>, Sayed. M. El-Araby<sup>\*\*\*</sup>, And Elsayed. H. M. Ali<sup>\*\*\*</sup><sup>\*</sup>Faculty of Computers and Information, Menoufia University, Egypt<sup>\*\*</sup>Industrial electronics and control department, Faculty of electronic engineering, Menoufia University, Egypt<sup>\*\*\*</sup>Engineering and scientific instruments department, nuclear research center, Atomic energy authority, Cairo, Egypt  
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**Abstract:** The steam generator is a highly complex, nonlinear and time-varying system and its parameters vary with operating conditions. A method to improve the performance of nuclear steam generator in nuclear power station is introduced. Combination of genetic algorithm technique and fuzzy logic control is carried out. The optimal parameters of fuzzy logic controller are achieved. These parameters include; the membership functions of water level error and changes water level error, the rule base, and the input scaling gains. Steam generator model implemented using MATLAB/SIMULINK. The optimal controller was applied to control the water level of nuclear steam generator and it's compared with conventional controller. Simulation results indicate that the optimal fuzzy controller greatly improves the performance of nuclear steam generator. Moreover the proposed controller is robust to any disturbance related to sudden changes in steam flow rate and water level. Moreover the proposed controller is robust to any disturbance related to load variations.

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**Keywords:** Fuzzy logic control, genetic algorithm, steam generator, nuclear power stations.

**1. Introduction**

Due to growing electricity demands, many countries are investing in nuclear power stations. During the operation of the nuclear power station, different changes in the operating conditions may occur such as water level in steam generator. Steam generator is a very important component of nuclear plant. It is of significance for nuclear reactor normal operation to maintain it work safely and reliably. For the steam generator in a nuclear power station, the main goal of its control system is to maintain the steam generator water level at a desired value [1]. The water level of a nuclear steam generator is of great importance in order to secure the sufficient cooling water for removing the primary heat and to prevent the damage of turbine blades [2]. The water level control problem of steam generator has been a main cause of unexpected shutdowns of nuclear power plants. In France, nuclear energy provides about 80% of the whole electricity production. This production must be able to vary proportionally to the consumption [3]. Figure 1 shows the steam generator (SG) in a nuclear power station [4].

It is very important to keep the operation of nuclear power station in highly safe mode. Therefore, an intelligent control system is required to compensate the steam flow rate changes produced sudden changes in load variations in the operating condition of the nuclear power station.

The conventional proportional– Integral (PI) controller [5] was used to control the water level of

the nuclear power stations. Simulation results show that conventional PI controller has long time delay between actual water level and reference level, big value of overshoot and undershoot, and bad tracking. Fuzzy Logic Control (FLC) is one approach of the Artificial Intelligence (AI) techniques that is used to control the performance of nuclear power stations [6],[7]. Simulation results show that the output response is improved, but it still insufficient to get an optimum response. The rule -base of fuzzy logic controller reflects the human expert knowledge, expressed as linguistic variables, while the membership functions represent expert interpretation of those same variables. In the absence of such knowledge, trial and error is a common approach used to optimize these fuzzy logic controller parameters, with respect to the performance of the system for each Knowledge base formulated [8]. This approach becomes impractical and not accurate for adjusting the parameters of membership function and rule base of nonlinear systems.

In this paper a genetic algorithm is proposed for optimal tuning parameters of fuzzy controller namely, rule base, membership function, and input scaling gains. The proposed genetic fuzzy controllers greatly improves the output response of the nuclear power station and dramatically decreases the overshoot and undershoot, the steady state error close to zero value, decreases the settling time and rise time. The paper organized as follows: Section one describe the mathematical model of nuclear steam generator.

Section two gives verification of the water-level behavior for the UTSG

Section three gives the design of water level controller for UTSG. Section four gives results and discussion, and final section is the conclusions.

## 1. Mathematical Model of U- Tube Steam Generator (UTSG)

A steam generator shows complicated dynamic behaviors with nonlinear characteristics. Some theoretical models based on the thermodynamic experiments and/or energy conservative equations have been developed to use for operator training simulator and accident analyses and so on. However, these are inadequate as mathematical models for designing controllers due to complexities. In this paper the Irving's steam generator model [9] has been used described in equation 1 which has been widely used for control purposes. The Irving's model is a linear parameter varying model of which parameters depends on reactor power level, listed in Table 1.

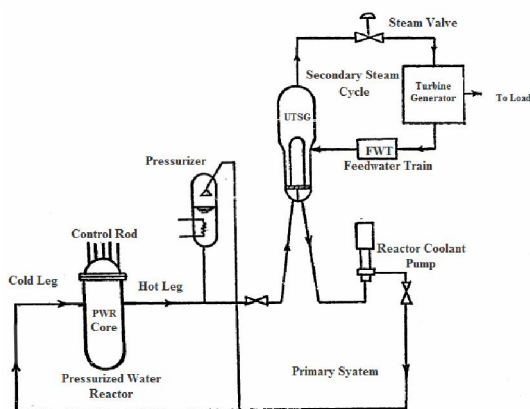


Fig. 1 Layout of steam generator (SG) in a nuclear power station

### 1.1. UTSG dynamics

The simulation model was developed using the Simulink [10] utility due to its friendly user interface and high flexibility environment [11] as shown in Figure 1. The following parts describe the simulation of UTSG model which can be divided to the following necessary parts:

- Water level output of UTSG.
- Mass capacity effect of the UTSG.
- Thermal negative effect caused by "swell and shrink".
- Mechanical oscillation effect caused by the inflow of the feed-water to the UTSG.

The Irving's model is a linear parameter varying model of which parameters depends on nuclear reactor power level, listed in table 1. The simulation model was developed using the SIMULINK [10]

utility due to its friendly user. A top view of SG model implemented in Simulink is shown at Figure 2.

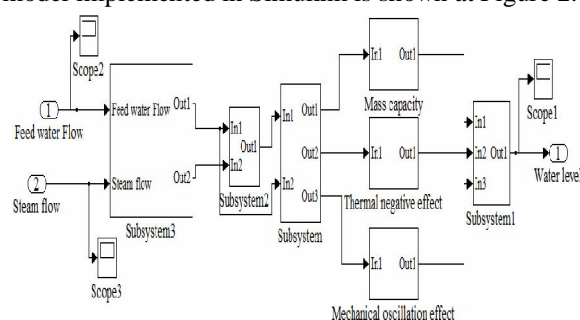


Fig. 2. A Top view of steam generator model implemented in Simulink

The water level of UTSG is given by the following equation:

$$y(s) = \frac{G_1}{s} (Q_w(s) - Q_s(s)) - \frac{G_2}{t_2 s + 1} (Q_w(s) - Q_s(s)) + \frac{G_3 s}{s^2 + 2t_1^{-1}s + t_1^{-2} + 4p^2 T^{-2}} Q_w(s) \quad (1)$$

Where:  $y(s)$  is water level of steam generator,  $Q_w(s)$

is feed-water flow-rate,  $Q_s(s)$  steam flow rate, is oscillation period, and  $\tau_1$ ,  $\tau_2$  are damping time constants.  $G_1 s$  is the mass capacity effect of the UTSG. It integrates the flow difference to calculate the change in water level. This term accounts for the level change due to feed water inlet to steam generator and the steam outlet from it. This quantity means the actual water capacity which critically affects the removal capability of the primary heat.  $G_1$  is a positive constant and does not depend on load.

$G_2 (\tau_2 s + 1)$  is the thermal negative effect caused by "swell and shrink". Since these phenomena exhibit exponential responses for step changes of the feed water flow-rate and the steam flow-rate, they are described by a first-order equation.  $G_2$  is positive and dependent on load. As load increases  $G_2$  decreases.

$\left[ G_3 s / (s^2 + 2t_1^{-1}s + t_1^{-2} + 4p^2 T^{-2}) \right] Q_w(s)$  is the mechanical oscillation effect caused by the inflow of the feed-water to the UTSG.

This is a mechanical oscillation term due to momentum of the water in the downcomer. All the water removed from the steam is returned to the downcomer and is recalculated. The recalculating water has large momentum acting against relatively small flow-rate changes. When the feed-water flow-rate is suddenly decreased, the water level in the downcomer falls initially and then begins to oscillate. This is due to the momentum of the water in the downcomer keeping the recalculating flow going



down initially and then slowing down. The mechanical oscillation disappears completely after a small multiple of the damping time constant. The variable  $G_3$  is positive. The dynamics of nuclear steam generator model can be described by the following state-space equations:

$$\frac{dx}{dt} = Ax(t) + Bu(t)$$

$$y(t) = Cx(t) \quad (2)$$

Where  $x(t) = [x_1(t), x_2(t), x_3(t), x_4(t), x_5(t)]^T$  is the state vector,  $u(t)$  is the control input,  $y(t)$  is the output, and A, B, C are defined in (3)

$$A = \begin{bmatrix} 0 & 0 & 0 & 0 & G_1 \\ 0 & -\frac{1}{\tau_2} & 0 & 0 & -\frac{G_2}{\tau_2} \\ 0 & 0 & -\frac{2}{\tau_1} & 1 & G_3 \\ 0 & 0 & -(\tau_1^{-2} + 4\pi^2 T^{-2}) & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} \quad C = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}^T \quad (3)$$

The model parameters at different powers have been identified [9] from experimental data and are given in Table 1.

Table (1): Steam generator dynamic parameter according to operating power

Power %	$\tau_1$	$\tau_2$	T	G1	G2	G3	$Q_{ST}$ (kg/s)
5%	41.9	48.4	119.6	0.058	9.63	0.181	57.4
15%	26.3	21.5	60.5	0.058	4.46	0.226	180.8
30%	43.4	4.5	17.7	0.058	1.83	0.310	381.7
50%	34.8	3.6	14.2	0.058	1.05	0.215	660
100%	28.6	3.4	11.7	0.058	0.47	0.105	1435

## 2- Verification of the Water-Level Behavior for UTSG

The transient behavior of the water level is dominated by the thermodynamics of the two-phase mixture in a steam generator and exhibits an inverse response behavior, which is the so-called “swell and shrink” phenomenon. As the steam flow rate increases, the pressure on the steam dome region of the steam generator decreases and the two phase flow mixture expands and shows an increase in the water level (swell). On the other hand, as the feed-water flow rate is increased, the steam bubbles in the two phase flow mixture collapse showing a decrease in the water level (shrink). These two effects are more severe especially at low operating powers and cause difficulty in an effective controller design for the UTSG. The numerical simulation for verifying the “swell and shrink” behavior is done as by simulating the Transient responses of the narrow range water level of SG at different operating powers (5%, 15%, 30%, 50% and 100% full power) due to step increase

in feedwater flow -rate. And Transient responses of the narrow range water level of SG at the same different operating powers due to step increase in the steam flow-rate. Figure 3 and figure 4 shows the responses of steam generator water level to step changes in feedwater and steam flow rates at different operating powers respectively.

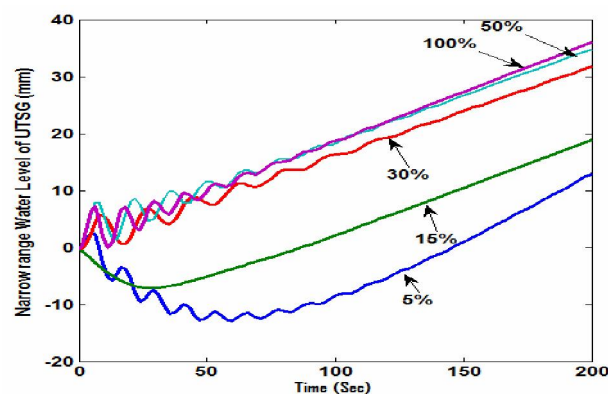


Fig. 3 Responses of SG water level at different operating powers to a step in feed-water flow rate

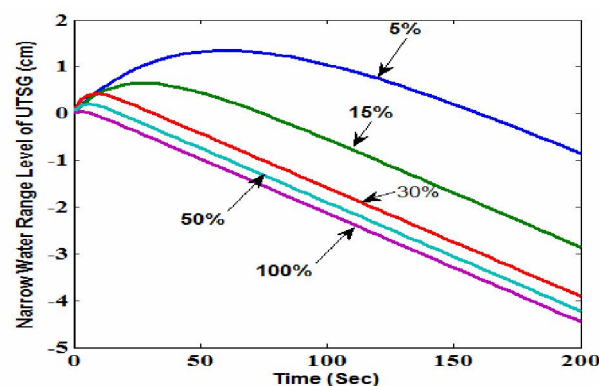


Fig. 4 Responses of SG water level at different operating powers to a step in steam flow rate.

## 3-Design of water level controller for UTSG

The command to the controlled system is the desired water level of the SG. A PI controller is chosen as a conventional controller. There are number of design requirements where established, based on step time response; reducing overshoot oscillation, and settling time, quick response good disturbance rejection.

### 3.1 Conventional controller

A Proportional-Integral controller or PI is a standard feedback loop component in industrial control applications. It measures an “output” of a process and controls an “input”, with a goal of maintaining the output at a target value, which is

called the "set point". For conventional control of SG, PI controller was used [12].

$$U_{level}(t) = K_{pl}(t) + K_{il}(t) \int_0^t e_l(t) dt \quad (4)$$

Where  $U_{level}(t)$  is level control signal,  $e_l(t)$  is level error signal (mm) and its is equal the difference between level set point and actual level of UTSG, and  $K_{pl}$ ,  $K_{il}$  are the proportional and integral gains of level controller respectively.

### 3.2 Fuzzy logic controller

Fuzzy logic control is based on the principles of fuzzy logic developed by Zadeh in 1965. It is a non-linear control method, which attempts to apply the expert knowledge to design the required controller. Based on the operator experience, structure of UTSG and flow diagram of water and steam inside the steam generator, the proposed structure of the fuzzy controller has two inputs and one output. These inputs of UTSG are water level error (WLE) and the rate of change in water level error (CWLE) respectively. Figure 5 shows the initial membership functions of the fuzzy controller. Five triangular membership functions for two inputs and one output, the linguistic terms for defining the membership functions are: NB is negative big, NS is negative small, ZE is zero, PS is positive small, and PB is positive big. Initial 25-rule base of fuzzy logic controller is shown in Table 2.

Table (2) Initial fuzzy rules of fuzzy controller

		Water Level error				
		NB	NS	ZE	PS	PB
Change in water level error	NB	NB	NB	NB	NS	ZE
	NS	NB	NS	NS	ZE	PS
	ZE	NB	NS	ZE	PS	PB
	PS	NS	ZE	PS	PS	PS
	PB	ZE	PS	PB	PB	PB

Once the membership functions and the rule-base of the fuzzy logic controller are determined, the next problem related to its implementation is the issue of tuning, which remains a more difficult and sophisticated procedure since there is no general method for tuning the fuzzy logic controller [13],[14] and [15]. Moreover the fuzzy control method has some limitations from the fact that its performance largely depends on initial membership function parameters and how to settle a rule base [16]. So, the Genetic Algorithm is applied to optimize parameters of fuzzy logic controller and input scaling gains.

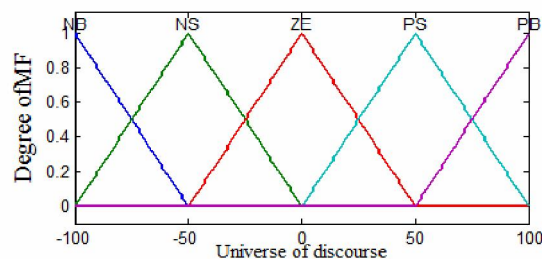


Fig. 5. Membership of function of fuzzy controller

### 3.3 Genetic fuzzy controller design

The optimal fuzzy controller is a fuzzy logic controller that is tuned off-line by the GA [17],[18]. To design the optimal fuzzy controller, the genetic algorithms are applied to search the globally optimal parameters of the fuzzy logic, and the Pittsburgh approach [19] is used to reduce the required chromosome length that represents the different component of fuzzy logic controller. A number of assumptions 'that were made in respect of the fuzzy logic controller to be optimized' are discussed in the following:

#### 3.3.1 Decoding fuzzy logic using GA chromosome

The primary assumption for the design of OFC is a symmetrical system; a corresponding fuzzy logic controller would also exhibit symmetry about the set point in respect of its membership functions and rule base. This assumption was exploited in order to attempt to reduce the number of bits required to define the fuzzy logic controller for genetic algorithm optimization.

#### 3.3.2 Genetic tuning of rule-base

Genetic tuning of rule base assumes a predefined set of fuzzy membership functions in the data base. A total of 9-bits in chromosome are used to extract rule base consistent with the following assumptions;

- 1- The magnitude of the output control action is consistent with the magnitude of the input values, mid-range input values in mid-range output values, and small/zero input values in small/zero output values.
- 2- If a large negative (positive) input generates a large negative (positive) response, then it is likely that slightly smaller, negative (positive) inputs will necessitate a response of like polarity, but smaller magnitude, and so forth until a zero-crossover point is reached at which point the polarity of the response changes[20],[21].

#### 3.3.3 Tuning membership functions

To encode the fuzzy logic controller membership functions associated with the two inputs and one output, a number of assumptions are made in respect of the distribution of fuzzy sets across the universe of discourse (UOD) for each fuzzy variable of fuzzy controller. These assumptions are;

1-The UOD is symmetrical about the central, zero regions for each variable.

2-The inner and central UOD-range membership functions could assume either triangular membership function, or trapezoidal membership function, shapes only [22],[23],[24].

3-The number of fuzzy sets for the controller was fixed at five (NB, NS, ZE, PS, PB).

The evaluated fuzzy logic controller contains three variables, WLE, CWLE as input variables and output as control-action. Seven bits for each variable are used to define the properties of the membership functions to be optimized. For each variable, their respective seven bits of GA-chromosome segments are sub-divided into two fields:

(a) The offset field. Three bits are used to effect change of shape to the membership functions from triangular to trapezoidal of varying widths and positions. In addition the algorithm uses the offset value to ensure the following constraints are observed by every evaluated fuzzy logic controller. A 50% overlap is maintained between adjacent membership functions.

(b) The expansion and compression factor field. Four bits are used to affect expansion/compression of the membership functions.

### 3.3.4. Decoding fuzzy logic controller scaling gains

The GA is used to optimize two fields, WLE-scaling and CWLE-scaling, are included in the GA -chromosome. Each consisting of 7- bits, which are decoded to yield values of gain for the appropriate gain blocks of the fuzzy logic controller.

### 3.3.5. GA objective function

The convergence of the genetic algorithm to a feasible solution depends upon some objective measure of each potential fuzzy logic controller performance; the target of the control is the minimization of the error. In this work the genetic algorithm is driven by the minimization of the mean square error as illustrated in equation 5, [25],[26].

$$F(x) = \frac{1}{N} \sum_{k=1}^N (y(k) - y_{ref}(k))^2 \quad (5)$$

Where  $F(x)$  is the fitness function,  $y(k)$  is the actual water level of steam generator simulation model in correspondence of the parameters proposed by a chromosome,  $y_{ref}(k)$  is the desired reference trajectory of water level, and  $N$  is the number of time steps in which the mission time is divided. During the

search, an archive of the best solutions found in the successive generations is kept updated.

In order to design the OFC, we define some simulative parameter of genetic algorithm as follows, algorithm used double -point crossover, crossover rate is 0.65, mutation rate is 0.003, proportional fitness assignment binary chromosomes (gray decoding) and non-overlapping population updates, a population size is 30, chromosome length is 44. Finally the solution of the final optimization problem is achieved using the Genetic Algorithm Toolbox for MATLAB [27], and has been utilized to carry out the automatic optimization of fuzzy controller [28].

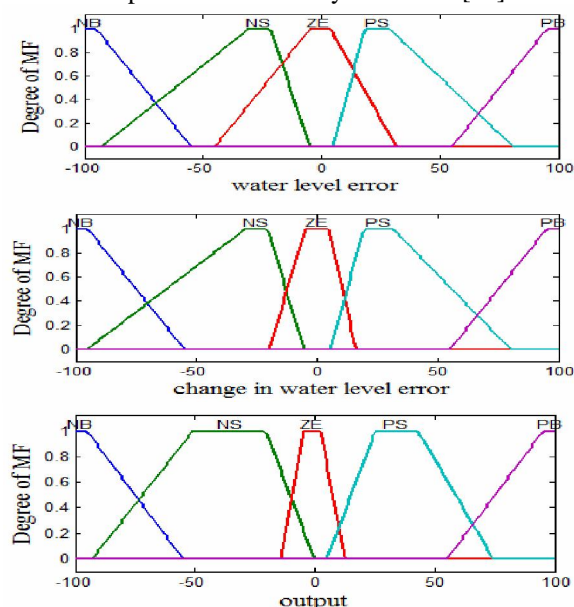


Fig. 6. Optimized MF of Fuzzy Controller

## 4-Results and discussion

For all simulations of the designed controller, the optimal fuzzy controller was tuned off-line. After running the GA, it gives the optimal fuzzy controller parameters as following; proportional scaling gain is 0.992, derivative scaling gain is 5.91811, the optimal solution at GA-chromosome is 00110000110110011001010110001101110101101110, the optimized MF for two inputs and output of fuzzy controller is shown in Figure 6, and the optimized fuzzy inference rules are listed in Table 4.

Several tests are implemented to validate the efficiency of the designed optimal fuzzy controller. In our simulation, at 5% of full power of nuclear power station the water level is step increased from zero level 150 mm at instant 200 second, then at time 1500 second the water level is subjected to sudden change in steam flow rate as disturbance increased from zero level to 28.4 kilogram per second (kg/s).

Table 3. The optimized fuzzy rules

		Water Level error				
		NB	NS	ZE	PS	PB
Change in water level	NB	NB	NB	NB	NS	ZE
	NS	NB	NB	NS	ZE	PB
	ZE	NB	NS	ZE	PS	PB
	PS	NB	ZE	PS	PB	PB
	PB	ZE	PS	PB	PB	PB

### 5-Conclusion

This paper focuses on the level control of a steam generator in a nuclear power station. It is very difficult to effectively control the water level of nuclear steam generator, because swelling and shrinking caused by many kinds of disturbances, such as a feed water flow rate, feed water temperature, main steam flow rate, and coolant temperature. Control of UTSG water level strongly affects nuclear power station availability. There has been a special

interest in this problem during low power transients because of the dominant thermal dynamic effects known as shrink and swell. Also, the non-minimum phase property, changing parameter according to power level, make it difficult to control the water level of a steam generator. In this paper, Combination of genetic algorithm technique and fuzzy logic control was carried out. The optimal parameters of fuzzy logic controller are satisfied. These parameters include; the membership functions of water level error and changes water level error, the rule base, and the input scaling gains. The main advantage of the proposed controller is capability to deal with sudden changes in water level variation due to steam flow rate changes, hence it reduces impulses appears in feed water flow rate. So we can say also that Simulation results indicate that the proposed controller greatly improves the performance of nuclear steam generator. Moreover the proposed controller is robust to any disturbance related to steam flow rate variations.

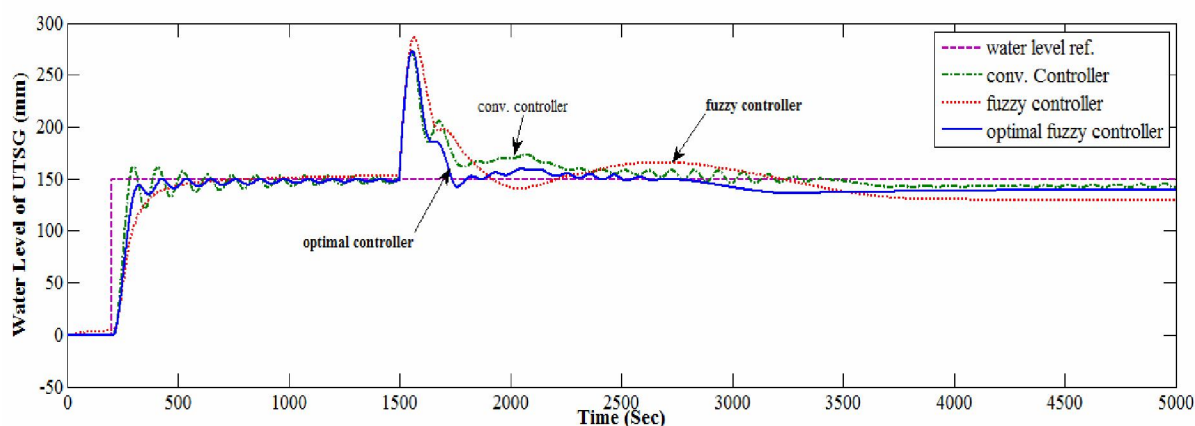


Fig.7 steam generator water level response for conventional and optimal fuzzy controller

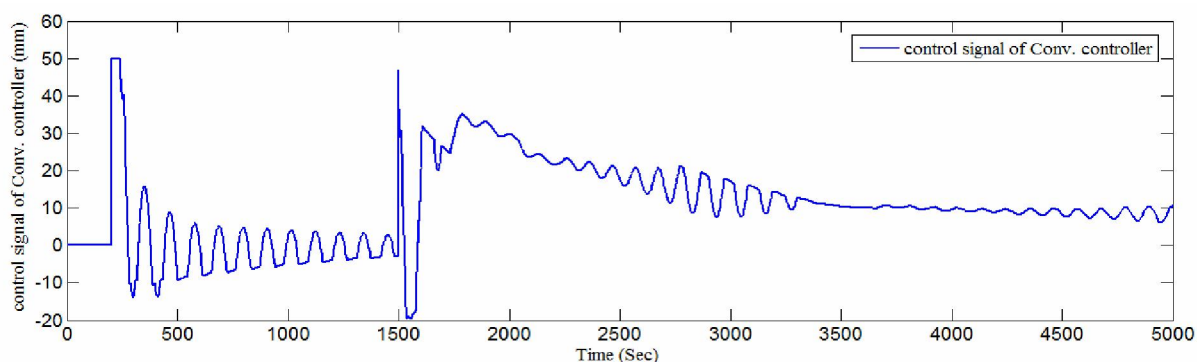


Fig. 8. (a) Control signal of conventional controller (mm)

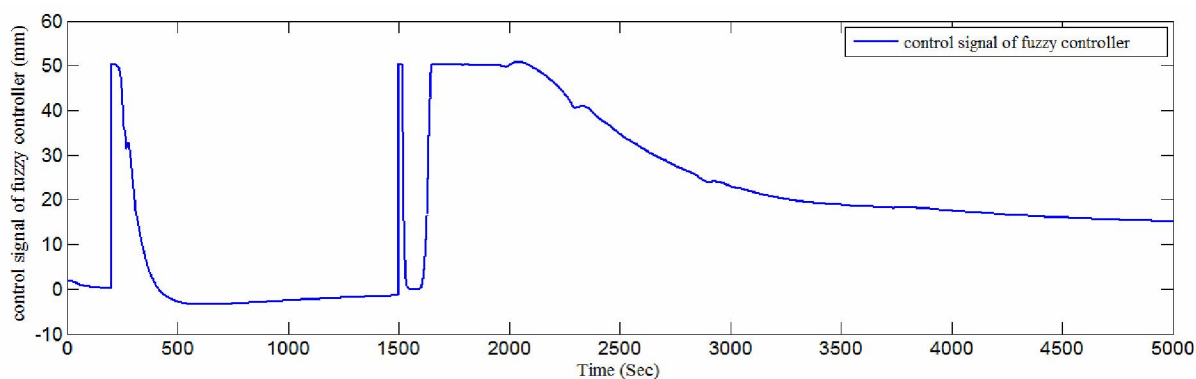


Fig. 8. (b) Control signal of fuzzy controller (mm)

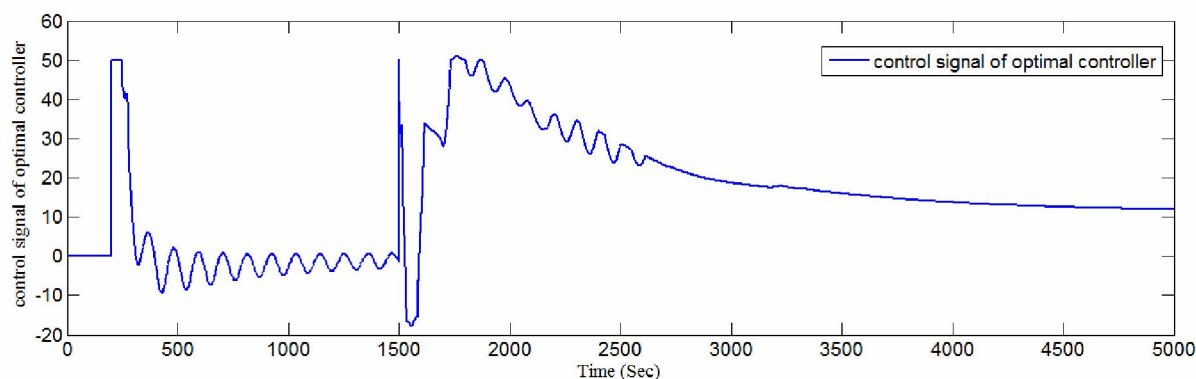


Fig. 8. (c) Control signal of optimal fuzzy controller (mm)

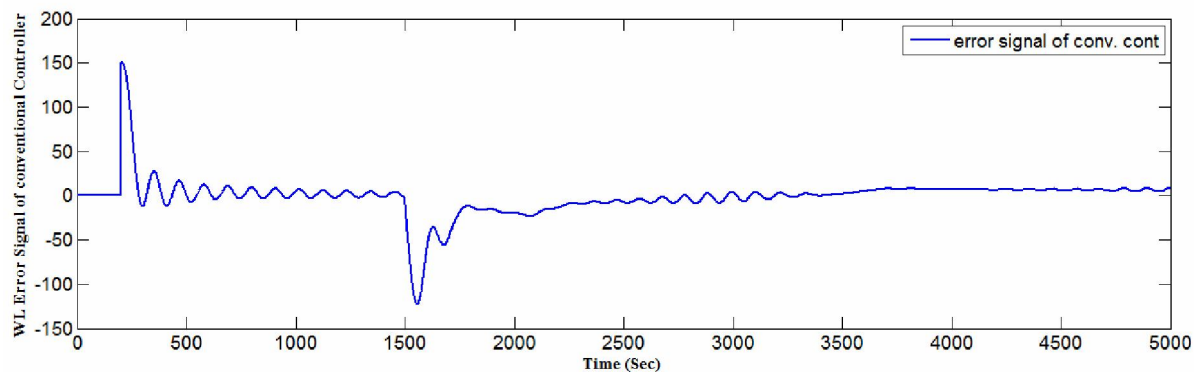


Fig. 9. (a) Water level error signal of conventional controller (mm)

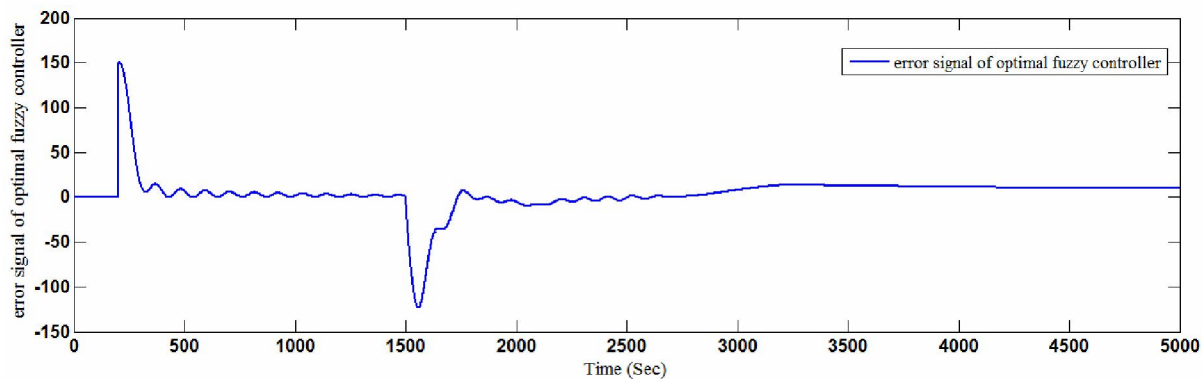


Fig. 9. (b) Water level error signal of fuzzy controller



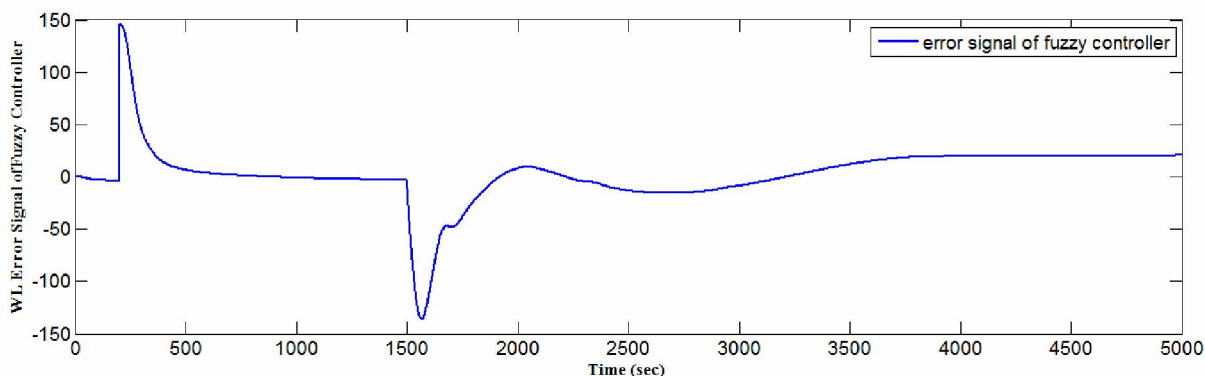


Fig. 9. (c) Water level error signal of optimal fuzzy controller (mm)

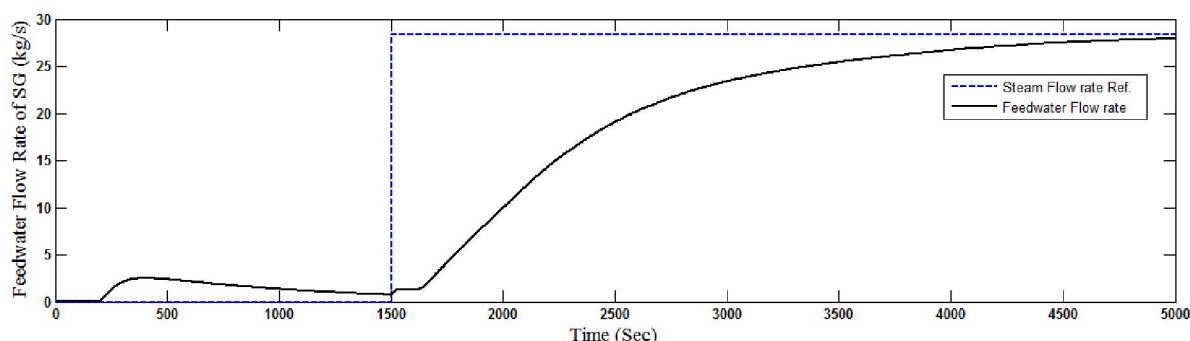


Fig.10. Feedwater flow rate of steam generator when steam flow rate is 28.4 kg/s

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## Role of Dietary Fibers in the Management of Diabetes Induced Heart Disease in Male Rats

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**Abstract:** The present study was conducted to evaluate the effect of oat or wheat bran (as a source of dietary fibers) on the heart disease associated with streptozotocin (STZ)-induced diabetes in male rats. As a result of induction of diabetes, the level of serum glucose and lipids (total lipids, triglycerides, total cholesterol, LDL-C, vLDL-C), as well as activity of lactic dehydrogenase (LDH) and creatinine kinase (CK) were increased, while HDL-C level was decreased. This goes in parallel with a significant reduction in the level of serum insulin and T-homocystein (tHcy). Furthermore, a reduction of total protein and glycogen content in the heart of diabetic rats were recorded. In addition, the diabetic rats exhibited marked trend for increased malondialdehyde and protein carbonyl levels, accompanied with decreased glutathione content in the heart tissue, which together with the other reported abnormalities predict development of heart disease as a result of diabetes. In contrast, feeding diabetic rats on diets supplemented with 7% oat or wheat bran was found to be effective in the management of diabetes-induced changes with the greatest effect being achieved with oat bran administration. Thus, it can be concluded that diet high in plant fibers, particularly oat bran is useful in reducing the development of heart disease associated with diabetes.

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**Keywords:** Dietary Fiber; Management; Diabetes; Heart Disease; Rat

### 1. Introduction:

Diabetes mellitus is frequently associated with heart disease that represents one of the most prevalent causes of death worldwide (Sarafidis *et al.*, 2005). Several risk factors, including hyperglycemia, insulin lack, insulin resistance and lipid abnormalities seemed to play a major role in the etiology of this disease (De Fronzo and Ferrannini, 1991). Recent research reveals that dietary modification such as increasing intake of plant fiber can improve insulin sensitivity, glucose tolerance and other metabolic disturbances associated with diabetes (Galisteo *et al.*, 2008).

Dietary fiber is a collective term for a variety of plant substances that are resistant to digestion by human gastrointestinal enzymes (John *et al.*, 2004). Since they are not absorbed into the body, dietary fibers are not a nutrient. Dietary fibers can be classified as either water soluble or insoluble, based on its ability to hold water and swell or not (Galisteo *et al.*, 2008). The structural or non viscous fibers (lignin, cellulose and some hemicellulose) are water insoluble. Vegetables, cereals and grains are especially rich in water insoluble fiber, with the highest amount found in wheat and corn. Water-insoluble fiber is responsible for increased stool bulk and help to regulate bowel movements. The natural gel-forming or viscous fibers (pectins, gums, mucilages, algal polysaccharides, some

polysaccharides and some hemicelluloses) are water soluble. Food rich in water-soluble fibers are dried beans, barely, oats, and some fruits and vegetables (Anderson *et al.*, 1990). Of total dietary fiber intake, approximately 20% is water soluble and 80% is water insoluble (Bazzano *et al.*, 2003). Studies in this field have postulated that high intake of unrefined cereals (rich in insoluble type) is beneficial in relation to non-infectious diseases, such as gastrointestinal problems and certain cancers, especially that of large bowel (Chatenoud *et al.*, 1998). Science then, numerous studies indicated that increased consumption of both types of dietary fibers is effective in preventing or treating chronic diseases, including heart disease and diabetes (Venn and Mann, 2004). Results of other studies recommended insoluble dietary fiber as a way of reducing food intake, body weight, and obesity (Olmo *et al.*, 2007), as well as ameliorating hyperlipidemia and other cardiovascular risk factors (Jacobs *et al.*, ). It was also demonstrated that high intake of soluble dietary fiber help to reduce total cholesterol, LDL-C and thereby the risk of heart disease among normal and hyperlipidaemic subjects (Mäkki, 2001). Other epidemiologic studies linked increased consumption of dietary fiber with reduced incidence of diabetes (Meyer *et al.*, 2000). In the same way, some experimental studies indicated that soluble dietary fibers can improve blood glucose and decrease body's

need to insulin (Casiraghi *et al.*, 2006). The related mechanism may be enhanced insulin sensitivity (Ylonen *et al.*, 2003) and decreasing insulin resistance (Temple *et al.*, 1992). In the light of these findings, the present study was undertaken to evaluate whether prolonged intake (3 months) of diet rich in two types of plant fibers could play a positive role in reducing development of heart disease associated with diabetes. The selected approach was to use two types of plant products, oat bran (as a source of soluble fiber) and wheat bran (as a source of insoluble fiber) to compare their effects in this context.

## 2. Materials and Methods

### 1- Materials

#### A- Experimental animals:

Sixty (60) male albino rats (*Rattus rattus*) weighing from 130-150 g were used in the present study. They were obtained from Helwan Animal Farm, Cairo, Egypt. Animals were kept under good ventilation and received a balanced diet and water *ad libitum*. They were acclimated to laboratory conditions for 2 weeks prior to experimentation.

#### B- Chemicals:

Streptozotocin (STZ) was obtained from Sigma Company, Egypt. All other reagents were purchased from El-Gomhoria Co., Egypt; and all the reagents were of analytical grade.

#### C-Plant Fibers:

Wheat bran (as a source of insoluble fiber) and oat bran (as a source of soluble fiber) were obtained from local market, Mansoura city, Egypt.

#### D- Induction of diabetes:

At the start of the experiment, diabetes was induced by intraperitoneal injection of (STZ) to overnight fasted rats. STZ was applied as a single freshly prepared dose (50 mg/kg b.wt) dissolved in citrate buffer pH 4.4 (Nandini *et al.*, 2000). Successful induction of diabetes was assessed 3 days after STZ injection by performing glucose urine analysis, using glucokotest obtained from Condor-Teco Technology Co.Ltd Netherland for *in vitro* analysis.

#### E- Experimental diet:

The control group was fed a standard normolipidemic diet consisting of protein 21%, fat 3.2% and fibers 3.44%, according to The Nutrient Requirements of Laboratory Animals (1995).

#### F- Animal grouping

The rats were divided into six groups; each of 6 rats, the first group was maintained untreated and served as a control animal. The second and third groups received diet supplemented with 7% of wheat bran or oat bran, respectively as described by Cameron-Smith *et al.* (1997). The fourth group is diabetic untreated animals. The fifth and six groups are

diabetic animals given diets supplemented with wheat bran or oat bran at the same dose as described in the second and third groups.

At the end of the experimental period (3 months), animals were overnight fasted and sacrificed under ether anesthesia. Blood was collected in non-heparinized centrifuge tube, and centrifuged for 15 minutes at 860 G. Non hemolized sera were separated and kept at -20°C for further analysis. Thereafter, liver and heart specimens were removed, weighed and homogenized for later biochemical measurements. Other specimens of liver and heart were weighed and kept in trichloroacetic acid solution (TCA) for determination of glycogen content.

### 2- Methods

#### Estimated parameters:

Levels of glucose and lipid profile (total cholesterol (TC), triglycerides (TG) and HDL-C) were estimated using colorimetric kits purchased from Spinreact CO., Spain, as described by McCleary and Codd (1991). and Young (1995) respectively. Liver glycogen content was determined as described by (Nicholas *et al.*, 1956), while reduced glutathione (GSH) was estimated according to the method of Prins and Loose (1969). Total lipids (T.lipids) and total protein (T.protein) were estimated using kits from diamond diagnostic, Cairo, Egypt according to the methods of Henry (1964) and Frings *et al* (1972), respectively. Serum insulin level was estimated using IMMULITE/IMMUULITE 1000 analyzer, according to the method of Chevenne *et al.*, (1998). LDL-C and VLDL-C concentrations in serum was calculated according to the formula applied by Friedewald *et al.* (1972), while the atherogenic index (AI) was calculated according to the equation described by Pandya *et al.* (2006).

The activity of creatinine kinase (CK) was estimated using kinetic kit from Elitech, Division de SEPPIMS. A Zone Industrielle, France, while lactic dehydrogenase (LDH) activity was estimated using kinetic kit from Humman, Gesellschaft for biochemical and diagnostica, Wiesbaden Germany, according to Young (1995) and Witt and Trendelenburg (1982), respectively. The level of malondialdehyde (MDA) (the end product of lipid peroxidation) was determined as a thiobarbituric acid reactive substance (TBAR) according to a modification of the method of Ohkawa *et al.* (1982), while protein carbonyl (PC) content was measured as described by Smith *et al.* (1991). Serum total homocysteine (tHcy) concentration was measured using IMMULITE/IMMUULITE 1000 analyzer, according to method of Bastom and Lathrop (1997).

### 3- Statistical analysis:

In the present study, obtained results were analyzed by One Way ANOVA (analysis of variance) test and post comparison was carried out with Tukey test. The results were expressed as means  $\pm$  standard error (SE). The criterion for statistical significance was  $p < 0.05$  (Snedecor and Cochran, 1982).

### 3. Results:

In the present study, diabetic rats exhibited significant ( $P < 0.05$ ) increase in the serum glucose and lipids (TL, TC, TG, LDL-C, vLDL-C), whereas serum levels of insulin, HDL-C, and tHcy showed significant reduction (Table 1). Similarly, the present results showed significant reduction in CK and LDH activities, accompanied with significant ( $P < 0.05$ ) increase in MDA and PC levels in heart tissues of diabetic rats, but reduction in total protein, glycogen and GSH in both liver and heart tissues of diabetic rats was also noticed (Table 2, 3).

On the other hand, feeding diabetic rats on diet supplemented with (7 % oat bran or wheat bran) helped to produce beneficial effects, which seemed of significant ( $P < 0.05$ ) value for all tested parameters, including insulin, glucose, lipids, total protein, tHcy, CK, LDH and oxidative stress markers. However, the oat bran supplementation recorded higher effect than wheat bran.

Besides, dietary fibers supplementation exhibited similar benefits, regarding their effects on non-diabetic rats when compared with normal control rats. Thus, it could be concluded that dietary fibers, particularly oat type have favorable health advantages for both normal and diabetic cases.

### 4. Discussion:

A large number of studies in human and experimental animals have evidenced the association between diabetes mellitus and development of cardiac disease (Richard *et al.*, 2010). The characteristic metabolic disturbances (hyperglycemia and dislipidemia) seen in diabetes are considered the most common risk factors for developing this disease. The causes for these metabolic disturbances and the management approaches to reduce the associated cardiac disorders are the subject of this work.

STZ-induced diabetes is a well documented model of experimental type I diabetes. In the present study, STZ injected rats exhibited abnormal metabolic pattern, characterized by increased serum levels of glucose with reduced insulin concentration, indicating their diabetic state. Other studies have confirmed these effects and further indicated that both hyperglycemia and lowered insulin levels being linked to the pathogenesis of heart disease in diabetes (Andallu and Vardacharyulu, 2001). Insulin makes it

possible for most body tissues to remove glucose from blood for use as fuel, for conversion to other needed molecules or for conversion into glycogen to be stored in liver and muscle cells. Lowered insulin levels result in the reverse conversion of glycogen to glucose with consequent decrease in glycogen accumulation. This could explain the decreased ability of diabetic tissues to accumulate glycogen, as seen in this study and other diabetic states (Bamri-Ezzine *et al.*, 2003). Decreased glycogen accumulation in the diabetic tissues may be an indication of impaired energy reserves coupled with reduced functional capacity (Carley and Severson, 2005). Therefore, the present finding of decreased glycogen levels in the diabetic heart can be considered as a marker for developing heart dysfunction consequent to induction of diabetes. In this context, other studies suggested a direct association between hyperglycemia and deleterious changes in diabetic myocardium, including myocytes hypertrophy, vascular fibrosis and increased collagen deposition (Fiordaliso *et al.*, 2004). These changes are likely a result of hyperglycemia-induced non enzymatic protein glycation, with accumulation of advanced glycation end products (AGES) in the myocardium, which may alter cellular function. Apart from the role of hyperglycemia, the increased lipid profile is also so prominent during diabetes that has suggested to be a major risk factor predisposing diabetic patients to develop heart disease. Increased lipids in diabetes may result from increased mobilization of fatty acids from peripheral deposits, which is mainly attributed to insulin deficiency, since insulin normally inhibits lipolysis (Al-Shamaony *et al.*, 1994). In this context, it was evidenced that the increased level of T.cholesterol is frequently developed in different diabetic states (EL-Wakf, 1997; EL-Wakf *et al.*, 1997). Several studies indicated that people with diabetes compared to non-diabetic persons often has high cholesterol levels. In diabetes, the increased cholesterol is possibly resulting from decreased level of HDL-C, together with increased LDL-C concentrations (Kesavulu *et al.*, 2001).

As reported earlier, LDL-C is the major cholesterol carrier in the blood, about 60-80% of cholesterol is carried by LDL-C (Ruzaidia *et al.*, 2004). Some of cholesterol is used by tissue and others returned to liver (Quinet *et al.*, 2009), but if there is much LDL-C in blood, cholesterol may be deposited. On the other hand, HDL-C picks up cholesterol and take it back to liver for reprocessing or excretion by a pathway called reverse cholesterol transport. Consequently, decreased HDL-C is associated with decreased cholesterol removal from extra hepatic tissues and increased risk of developing



cardiovascular disorders. HDL-C is, therefore, recognized as a factor that protects against development of atherosclerotic disease and thus increased HDL-C is associated with a decrease in coronary heart disease (Gao and Yuan, 2010). In contrast, high levels of both T.cholesterol and LDL-C are considered as major coronary risk factor through enhancing atherosclerosis (Rizzo *et al.*, 2009). Based on this, the present findings of increased T.cholesterol, LDL-C and atherogenic index (AI), with decreased HDL-C concentrations can be considered as indication for enhanced atherosclerosis with further cardiac injury as a result of diabetes. Beside this, high levels of triglycerides and vLDL-C have also been detected under present diabetic state which may be attributed to lack of insulin levels. Normally, insulin acts to activate the enzyme lipoprotein lipase, being responsible for

catalyzing breakdown of triglyceride rich lipoproteins (vLDL-C and chylomicrons) (de Vries *et al.*, 2003). Thereby, insulin lack impairs the normal insulin mediated activation of lipoprotein lipase, which result in over production of vLDL-C and leads to increased plasma triglycerides. In this way, increased triglycerides are subsequently associated with an increase of myocardial disorders. Regarding this, it seems reasonable to predict development of cardiac disorders under present diabetic status, characterized by elevation in both triglycerides and VLDL-C, as in agreement with other data indicating that increased intramyocardial triglycerides content in patients with diabetes may cause lipotoxicity and cardiomyocyte apoptosis that ultimately leads to cardiac dysfunction (Witteles *et al.*, 2008).

**Table (1): Serum biochemical parameters in control and different treated rat groups.**

<b>Animal groups</b> <b>Parameters</b>	<b>Control</b>	<b>Wheat bran</b>	<b>Oat bran</b>	<b>Diabetic</b>	<b>Diabetic + wheat bran</b>	<b>Diabetic + oat bran</b>
<b>Glucose</b> (mg/dl)	89.38 ±1.88	89.33 ±3.04	86.08 ±2.88	457.46 ±19.07 <sup>a</sup>	182.83 ±4.98 <sup>ab</sup>	150.7 ±4.29 <sup>ab</sup>
<b>Insulin</b> (μIU/dl)	3.42 ±0.12	3.43 ±0.11	3.65 ±0.09	1.17 ±0.09 <sup>a</sup>	2.18 ±0.08 <sup>ab</sup>	2.39 ±0.08 <sup>ab</sup>
<b>T. lipid</b> (mg/dl)	554.94 ±1.85	539.59 ±2.45	518.26±1.91 <sup>a</sup>	816.15±1.91 <sup>a</sup>	642.23 ±4.01 <sup>ab</sup>	604.30 ±4.38 <sup>abc</sup>
<b>TC</b> (mg/dl)	89.5 ±0.86	84.70 ±0.96	82.15 ±0.89 <sup>a</sup>	121.24 ±0.72 <sup>a</sup>	111.66 ±0.88 <sup>ab</sup>	105.15 ±0.72 <sup>abc</sup>
<b>TG</b> (mg/dl)	95.69 ±1.44	89.37 ±0.90 <sup>a</sup>	84.93 ±1.40 <sup>a</sup>	136.16 ±1.54 <sup>a</sup>	124.27 ±1.34 <sup>ab</sup>	115.93 ±1.59 <sup>abc</sup>
<b>HDL-C</b> (mg/dl)	38.66 0.51	40.31 ±0.69	43.80 ±0.26 <sup>a</sup>	24.73 ±0.64 <sup>a</sup>	28.59 ±0.56 <sup>ab</sup>	29.45 ±0.69 <sup>ab</sup>
<b>LDL-C</b> (mg/dl)	31.70 ±0.51	26.51 ±0.69	21.36 ±0.26 <sup>a</sup>	69.27 ±0.64 <sup>a</sup>	58.21 ±0.56 <sup>ab</sup>	52.51 ±0.69 <sup>abc</sup>
<b>VLDL-C</b> (mg/dl)	20.17 ±0.99	17.87 ±0.18 <sup>a</sup>	16.98 ±0.28 <sup>a</sup>	27.23 ±0.31 <sup>a</sup>	24.85 ±0.27 <sup>ab</sup>	23.19 ±0.32 <sup>ab</sup>
<b>AI</b>	1.33 0.59±	1.10 ±0.68 <sup>a</sup>	0.87 ±0.42 <sup>a</sup>	4.99 ±0.67 <sup>a</sup>	2.90 ±0.60 <sup>ab</sup>	2.57 ±0.62 <sup>abc</sup>
<b>T. protein</b> (g/dl)	5.10 ±0.11	5.44 ±0.17	6.07 ±0.10 <sup>a</sup>	2.79 ±0.09 <sup>a</sup>	3.56 ±0.12 <sup>ab</sup>	3.94 ±0.05 <sup>ab</sup>
<b>tHcy</b> (mg/dl)	12.81 ±0.34	15.06 ±0.28	14.47 ±0.43	5.45 ±0.29 <sup>a</sup>	8.15 ±0.25 <sup>ab</sup>	9.46 ±0.31 <sup>ab</sup>
<b>CK</b> (U/L)	229.2 ±4.57	210.14 ±2.47	206.57 ±2.77	481.77 ±11.49 <sup>a</sup>	382.34 ±4.07 <sup>ab</sup>	331.36 ±6.68 <sup>abc</sup>
<b>LDH</b> (U/L)	438.14 ±4.25	378.44 ±10.54 <sup>a</sup>	336.22 ±6.29 <sup>a</sup>	672.55 ±8.12 <sup>a</sup>	544.11 ±3.71 <sup>ab</sup>	508.95 ±3.53 <sup>abc</sup>

All values are expressed as mean ±SE of 6 animals.

<sup>a</sup> Significant (P<0.05) on comparing with the control group.

<sup>b</sup> Significant (P<0.05) on comparing with the diabetic group.

<sup>c</sup> Significant (P<0.05) on comparing diabetic oat with diabetic wheat.

Table (2): Heart biochemical parameters and oxidative biomarkers in control and different treated rat groups.

<b>Animal groups Parameters</b>	<b>Control</b>	<b>Wheat bran</b>	<b>Oat bran</b>	<b>Diabetic</b>	<b>Diabetic + wheat bran</b>	<b>Diabetic + oat bran</b>
<b>Glycogen</b> (mg/g wet tissue)	59.74 ±0.95	69.93 ±0.3 <sup>a</sup>	72.88 ±1.17 <sup>a</sup>	24.46 ±2.12 <sup>a</sup>	32.62 ±1.06 <sup>ab</sup>	40.73 ±0.95 <sup>ab a&amp;b</sup>
<b>T. lipids</b> (mg/g wet tissue)	331.56 ±3.51	321.75 ±2.29	297.24 ±5.36 <sup>a</sup>	555.23 ±3.63 <sup>a</sup>	395.39 ±9.11 <sup>ab</sup>	356.73 ±2.6 <sup>abc</sup>
<b>TC</b> (mg/g wet tissue)	50.66 ±1.85	47.52 ±2.45	42.91 ±1.91 <sup>a</sup>	75.90 ±1.91 <sup>a</sup>	64.52 ±4.0 <sup>ab</sup>	59.35 ±0.9 <sup>abc</sup>
<b>TG</b> (mg/g wet tissue)	42.18 ±0.83	38.43 ±1.55	34.69 ±1.13 <sup>a</sup>	61.32 ±0.87 <sup>a</sup>	52.61 ±0.70 <sup>ab</sup>	49.03 ±0.76 <sup>ab</sup>
<b>T.protein</b> (mg/g wet tissue)	2.91 ±0.026	3.03 ±0.029	3.18 ±0.035 <sup>a</sup>	1.06 ±0.019 <sup>a</sup>	2.18 ±0.011 <sup>ab</sup>	2.37 ±0.02 <sup>abc</sup>
<b>CK</b> (mg/g wet tissue)	361.38 ±5.77	375.69 ±2.10	364.33 ±1.71 <sup>a</sup>	130.43 ±3.80 <sup>a</sup>	171.64 ±4.15 <sup>ab</sup>	191.28 ±4.25 <sup>abc</sup>
<b>LDH</b> (mg/g wet tissue)	428.60 ±3.29	434.57 ±2.46 <sup>a</sup>	57.484 ±2.46 <sup>a</sup>	253.42 ±4.23 <sup>a</sup>	312.63 ±3.14 <sup>ab</sup>	337.71 ±4.09 <sup>abc</sup>
<b>MDA</b> (nmol/ g wet tissue)	143.13 ±0.24	135.31 ±0.26	129.63 ±1.57 <sup>a</sup>	415.06 ±2.51 <sup>a</sup>	291.77 ±2.45 <sup>ab</sup>	249.26 ±1.93 <sup>abc</sup>
<b>PC</b> (μ mol DNPH/ mg wet)	0.44 ±0.02	0.36 ±0.014 <sup>a</sup>	0.31 ±0.016 <sup>a</sup>	0.82 ±0.015 <sup>a</sup>	0.63 ±0.012 <sup>ab</sup>	0.57 ±0.018 <sup>ab</sup>
<b>GSH</b> (mg/g wet tissue)	0.26 ±0.009	0.31 ±0.011 <sup>a</sup>	0.33 ±0.012 <sup>a</sup>	0.12 ±0.005 <sup>a</sup>	0.18 ±0.007 <sup>ab</sup>	0.21 ±0.021 <sup>ab</sup>

All values are expressed as mean ±SE of 6 animals.

<sup>a</sup> Significant (P<0.05) on comparing with the control group.

<sup>b</sup> Significant (P<0.05) on comparing with the diabetic group.

<sup>c</sup> Significant (P<0.05) on comparing diabetic oat with diabetic wheat.

Table (3): Liver biochemical parameters and oxidative biomarkers in control and different treated rat groups.

<b>Animal groups Parameters</b>	<b>Control</b>	<b>Wheat bran</b>	<b>Oat bran</b>	<b>Diabetic</b>	<b>Diabetic + wheat bran</b>	<b>Diabetic + oat bran</b>
<b>Glycogen</b> (mg/g wet tissue)	99.39 ±1.56	103.75 ±1.49	106.3 ±1.97	40.46 ±1.73 <sup>a</sup>	73.65 ±1.71 <sup>ab</sup>	83.39 ±1.75 <sup>abc</sup>
<b>T. lipids</b> (mg/g wet tissue)	644.62 ±3.65	621.16 ±4.78 <sup>a</sup>	580.77 ±6.33 <sup>a</sup>	874.66 ±5.15 <sup>a</sup>	735.90 ±2.39 <sup>ab</sup>	692.65 ±1.77 <sup>abc</sup>
<b>TC</b> (mg/g wet tissue)	169.32 ±1.20	152.30 ±2.13 <sup>a</sup>	139.36 ±1.34 <sup>a</sup>	214.76 ±1.54 <sup>a</sup>	202.66 ±1.41 <sup>ab</sup>	190.52 ±1.48 <sup>abc</sup>
<b>TG</b> (mg/g wet tissue)	130.84 ±5.56	130.92 ±1.50	119.45 ±3.38	181.70 ±1.32 <sup>a</sup>	162.83 ±1.69 <sup>ab</sup>	151.63 ±3.59 <sup>ab</sup>
<b>T. protein</b> (mg/g wet tissue)	3.90 ±0.025	4.07 ±0.019 <sup>a</sup>	4.16 ±0.014 <sup>a</sup>	2.07 ±0.035 <sup>a</sup>	3.11 ±0.013 <sup>ab</sup>	3.32 ±0.018 <sup>abc</sup>
<b>MDA</b> (nmol/g wet tissue)	279.13 ±2.48	261.78 ±3.08 <sup>a</sup>	241.14 ±4.83 <sup>a</sup>	672.68 ±3.72 <sup>a</sup>	484.06 ±3.21 <sup>ab</sup>	440.30 ±3.20 <sup>abc</sup>
<b>PC</b> (μmolDNPH/ mg wet tissue)	0.63 ±0.015	0.59 ±0.009	0.52 ±0.01 <sup>a</sup>	0.93 ±0.016 <sup>a</sup>	0.82 ±0.008 <sup>ab</sup>	0.79 ±0.009 <sup>ab</sup>
<b>GSH</b> (mg/g wet tissue)	0.28 ±0.01	0.31 ±0.01	0.36 ±0.02 <sup>a</sup>	0.11 ±0.09 <sup>a</sup>	0.19 ±0.006 <sup>ab</sup>	0.20 ±0.006 <sup>ab</sup>

All values are expressed as mean ±SE of 6 animals.

<sup>a</sup> Significant (P<0.05) on comparing with the control group.

<sup>b</sup> Significant (P<0.05) on comparing with the diabetic group.

<sup>c</sup> Significant (P<0.05) on comparing diabetic oat with diabetic wheat.

In searching for other (non lipid) factors responsible for incidence of cardiac disease in diabetes, special attention has been paid to the role of homocysteine. Homocysteine (Hcy) is thiol, non protein amino acid, not present in food, but generated from the essential amino acid methionine (Jacob *et al.*, 1998). Studies concerning Hcy in the diabetic patients have revealed either elevated (George *et al.*, 2004), or decreased (Wald *et al.*, 2002) Hcy levels. This contradiction could be related to changes in insulin concentration. Patients with insulin resistance syndrome showed elevated levels of plasma Hcy (Sheu *et al.*, 2000). Similarly, type II diabetic patients who have preserved pancreatic  $\beta$ -cells function and who are hyperinsulinemic, but insulin resistant have high Hcy concentration (Drzewoski *et al.*, 2000). However, the same patients when lose their  $\beta$ -cells reserve show a decline in Hcy concentration. On the other hand, type I diabetic patients, who are insulinopenic, have low Hcy levels (Cotellessa *et al.*, 2001). Analysis of the present results, revealed similar reduction in serum Hcy level as a result of diabetes, and further indicated that insulin lack observed in this study could be of help in explaining this finding, since insulin acts primary to stimulate uptake of amino acids, such as methionine which in turn can be converted to Hcy, thus increasing Hcy levels. In other way, decreased Hcy level may be contributed to impaired Hcy disposal pathway due to kidney dysfunction induced by diabetes, as kidney has important role in Hcy elimination. Normally, plasma Hcy has free and protein bound forms. Increased protein loss due to kidney dysfunction may cause decrease in protein bound fraction of Hcy (Ueland *et al.*, 1996). Since only the free fraction of total plasma Hcy should be filtered, which corresponds to approximately 70% of the total Hcy in rats (House *et al.*, 1998), the excessive protein loss in diabetes may cause acceleration of Hcy elimination with reduced Hcy levels (McKeever *et al.*, 1991). Therefore, the decreased serum protein concentration, as seen in this study could be considered as one mechanism for the lowering influence of diabetes on Hcy levels.

In this line, a number of recent studies have considered Hcy as an independent risk factor for the development of cardiovascular disorders in diabetes. Several mechanisms are suggested to be involved, among them is the increased oxidative stress as a result of Hcy alterations. The explanations is that Hcy can be broken down in healthy individuals into other thiol amino acids, such as cystein (Langman, 1999) which is considered as important rate limiting precursor for synthesis of the tripeptide glutathione (GSH) (Kidd, 1997). Homocysteine, cystein and GSH are the major amino thiols in human plasma,

which interact through disulphide exchange reactions (Iciek *et al.*, 2004). Alterations of any of these three thiols can therefore, affect the others. So, it seems responsible that decreased Hcy level recognized in diabetes may be linked to GSH depletions, as seen in this diabetic state and in other cases ((Ueland *et al.*, 1996). GSH is one of the most important non-enzymatic antioxidants in the cells and its depletion could lead to enhanced production of oxygen free radicals with increased oxidative stress (Bansal and Bilaspuri, 2010). It follows that reduction in both Hcy and GSH levels can cause a state of oxidative stress.

Oxidative stress has been suggested to play a major role in the pathogenesis of many diabetic complications (EL-Wakf, 1996). Oxidative stress is defined as a shift in the balance of cellular oxidation-reduction reactions in favor of oxidation, which leads to damage of the cells and formation of molecular products that are indicative of oxidative stress, such as protein carbonyl (PC) and malonaldehyde (MDA) products (Bhor *et al.*, 2004). Excessive production of these toxic species may cause cellular membrane damage, with subsequent alteration in cellular functions. In this context, several blood enzymes have shown to be indicative of cell damage with increasing cell membrane permeability. These enzymes become recognizable in the serum, presumably by leakage through diseased or damaged tissues with altered membrane permeability. Creatine kinase (CK) and lactate dehydrogenase (LDH) are energetic enzymes, which prominently present in cardiac tissue and can be used to assess heart injury or disease (Meas *et al.*, 2009). Therefore, the present finding of increased serum activities of both CK and LDH with decreased cardiac activity of these enzymes can be considered as indicator for myocardial damage, as evidenced here by the increased accumulation of both PC and MDA in the cardiac tissue of diabetic rats.

Considering these alterations, together with other variables potentially related to risk of cardiac disease in diabetes, efforts continue to the find suitable therapeutic approaches. The inability of clinical trials to find satisfactory approaches has led to a shift towards alternative forms of therapy derived from plants or plant products. In this respect, dietary plant fibers are considered as a functional food, i.e a food with health benefits. In the field of diabetes research, it was indicated that use of plant fibers, mainly soluble type from psyllium (Brown *et al.*, 1999), guar gum (Anderson *et al.*, 1991) and oat bran (Jenkins *et al.*, 2002) is beneficial in the control of metabolic disturbances being involved in the pathogenesis of most diabetic complications, including heart disease (Jacobs *et al.*, 2000). In accord, the present study evidenced that feeding

diabetic rats on diet supplemented with oat bran (rich in soluble fiber) has shown lowered diabetic hazards. This was observed mainly in terms of improving glucose, insulin and lipids, as well as oxidative stress markers, which may contribute to improved cardiac status as assessed here by the normalized cardiac biomarkers, CK and LDH. Such an effect was also found on feeding diabetic rats on wheat bran-diet (rich in insoluble fiber), however wheat bran was not as effective as oat bran. In this way, the present study have shown that diets rich in oat or wheat fibers are beneficial for reducing diabetes and associated cardiac alterations, with the most potential action being attained with oat bran fiber. The reason for this difference may be related to the type of consumed fibers being soluble or insoluble. The followings are specific properties for each fiber type which may help to understand their different actions.

In terms of soluble fibers, predominantly oat bran, several studies have evidenced the efficiency of this fiber type to normalize blood glucose and insulin levels. Oats soluble fiber comprise a class of non-digestible polysaccharides known as  $\beta$ -glucans that are found widely in barely, yeast, bacteria, algae, mushrooms and oats (Madhujith and Shahidi, 2007). The percentage of  $\beta$ -glucans in various oat products are: oat bran about 5.5 %, while rolled oats and whole flour, about 4 % (Pick *et al.*, 1996). Oat  $\beta$ -glucan was reported to have glucose regulating activity, that may be related to the ability of soluble fiber types to hold water and swell, resulting in highly viscous gastric contents that may delay gastric emptying and/or intestinal absorption. Thereby, reduce postprandial glucose levels and improve insulin sensitivity in both diabetic and non-diabetic persons (Sierra *et al.*, 2002). It also favors increasing glucose uptake into skeletal muscles by increasing muscles content of insulin-responsive glucose transporter type 4 (GLUT-4) (Song *et al.*, 2000). Soluble fibers may also affect secretion of gut hormones or peptides, such as cholecystokinin (CCK) or glucagon-like peptide-1 (GLP-1), independent of glycemic response, which may act as satiety factors or alter glucose hemostasis. However, the control of blood glucose levels can't attribute only to soluble fibers. Although insoluble fibers are mainly non viscous and have negligible effects on postprandial glucose responses and only small effect on macronutrient absorption (Galisteo *et al.*, 2008), surprisingly, most epidemiological studies clearly showed that increased consumption of mainly insoluble cereal fibers and whole grains has been recommended to improve whole-body insulin sensitivity (Weickert *et al.*, 2006), and to lower serum glucose concentrations (Wolever *et al.*, 1992). An effect that was associated with earlier increase of postprandial active values of

the glucose-dependant insulin tropic polypeptide (GIP) (Asmar *et al.*, 2010), which inturn may represent a mechanism for controlling glucose and risk of diabetes. It was also reported that insoluble fibers predominantly from wheat bran is a source of magnesium (Jenkins *et al.*, 1975). Decreased magnesium was associated with insulin resistance, and magnesium supplementation was found to improve glucose handling (Brown *et al.*, 1999). Thus, wheat bran may affect glucose homeostasis and risk of diabetes indirectly through high presence of micronutrients, such as magnesium.

Apart from this gluco-metabolic regulation, numerous clinical and animal studies have indicated improved lipid metabolism following intake of dietary fibers, mainly soluble type (Ludwig *et al.*, 1999). In particular, consumption of soluble fiber from oat products was found to decrease blood concentration of cholesterol, especially low density lipoprotein (LDL-C) among hypercholesterolemic patients (Ripsin *et al.*, 1992). Other investigators also described a significant reduction of plasma triglyceride concentrations following prolonged intake of diets with high soluble fiber contents. The major mechanism involved in the hypocholesterolemic effect of soluble fiber (most often consumed as  $\beta$ -glucan from oat) is mediated by increased excretion of bile acids which might explain its cholesterol lowering activity (Sayar *et al.*, 2006). Concerning the hypotriglyceridemic effect, it is consistent with a possible delay in the absorption of triglycerides from the small intestine (John *et al.*, 2004). However, other authors have related this effect to the fact that soluble fiber from different sources, such as oat barn might decrease VLDL-C synthesis rate and accelerate VLDL-C removal with subsequent lowering of plasma triglyceride. This hypolipidemic action of soluble fiber intake was similarly demonstrated following consumption of different sources of insoluble fibers, but in less pronounced way, as evidenced in the present study. In support, a comparative study also showed this effect by the finding that oat bran has an advantage over wheat bran in lowering serum lipids when tested on large number of individuals with initial mean serum cholesterol concentrations above the desirable range (Lia *et al.*, 1995). To date, no obvious mechanisms have been provided for the hypolipidemic action of wheat bran. However, almost studies on such wheat bran effect have focused on the role of insoluble fiber-lignin. Lignin constitute about 3 % of the weight of wheat bran (Mongeau and Brassad, 1982) that has shown to bind bile acids and reduce serum cholesterol (Kritchevsky and Story, 1974). Other studies have researched the impact of wheat protein-gluten. About 14% of the weight of wheat bran or 27

% of its energy content is protein (McCance and Widdowsoo, 1992). Studies with increased wheat bran intake may therefore increase protein intake. In particular, high protein-high fiber intake was found to increase bile acid loss in human (Cummings *et al.*, 1979), and hence reduce cholesterol level (Jenkins *et al.*, 2002). In previous metabolic study, an exchange of approximately 10 % of daily energy from carbohydrate to wheat-gluten resulted in a 13 % reduction in triglycerides (Salmeron *et al.*, 1997). It is possible that the reduction in triglycerides was the result of lowered level of carbohydrate in the diet and thus substituting other caloric sources from carbohydrate would result in reducing triglycerides level.

Other studies, regarding beneficial effects of wheat bran indicated that some of the components (characterized as phenolic acids) associated with the fiber (rather than the whole fiber) could be involved in this context. Phenolic acids of wheat bran are composed of ferulic, vanillic and p-coumaric, caffeic and chlorogenic acids (Bryngelsson *et al.*, 2002). The health effects of these acids have mainly attributed to its antioxidant activities (Yilmaz and Toledo, 2004). A study of seven wheat varieties showed that ferulic acid is the predominant component accounting for about 46-67 % of total phenolic acids, and may contribute to the main antioxidant capacity of wheat (Zhou *et al.*, 2004). Phenolic antioxidants are reported to quench oxygen derived free radicals by denoting a hydrogen atom and, therefore, limit the risk of various diseases associated to oxidative stress such as diabetes (Fardet *et al.*, 2008). Interestingly, oat like wheat contains large amount of antioxidants, which are also concentrated within the outer layer of grain, they are mainly vitamin E, phytic acid and phenolic acids (Peterson *et al.*, 2002). The total phenolic acids, mainly (avenanthramides, vanillic and B-hydroxybenzoic acids) was significantly correlated with the antioxidant capacity of oats. Avenanthramides are typically found in oats and have antioxidant activity in vitro (Peterson *et al.*, 2002) and in vivo (Chen *et al.*, 2007). Avenanthramide is a more powerful antioxidant than some of the typical cereal components, such as ferulic, p-hydroxybenzoic, vanillic and phytic acids (Martinez-Tome *et al.*, 2004). To date, no comparative studies are available on the antioxidant capacity of oat bran and other plant products, such as wheat bran. However, in the present study, oat bran was more effective in reducing oxidative stress markers (MDA and PC) and increasing the antioxidant GSH in the diabetic rats than was observed by wheat bran, thus indicating a higher antioxidant capacity of oat bran. A finding that may be related to the presence of more avenanthramides in

oat bran, while wheat bran has high concentrations of many other phenolic components with less antioxidant activity (Martinez-Tome *et al.*, 2004). Accordingly, it can suggest that both oat bran and wheat bran have additional physiological effects as related to the role played by the antioxidant components associated with the two bran types, however oat bran attained higher antioxidant activity than wheat bran.

## 5. Conclusion:

Considering the above all findings, it can conclude that consumption of diets high in plant fibers, particularly soluble type appears to be effective in reducing onset of diabetes and associated heart disease, through favorably influencing a number of risk factors including serum glucose, lipids and oxidative stress markers. Thus, emphasis on consuming food rich in soluble fibers as oats might be a safe, effective and low cost approach for diabetic people at risk of developing heart disease.

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## Field Study on Cadmium pollution in relation to internal parasitic diseases in cultured Nile Tilapia at Kafr El-Sheikh Governorate

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**Abstract:** The aim of this study is to explain the relation ship between cadmium pollution and internal parasitic infestation in tilapia fish. The present study was carried out on 400 specimens of Tilapia fish (*Oreochromis niloticus* (*O.niloticus*) ranged from 20 - 30 cm. While as their average body weights were ranged from 180 ± 10 g. The clinical signs revealed no pathognomonic abnormalities on the external body surface except in heavily naturally infested fish, represented as respiratory manifestation. The postmortem findings of investigated fish revealed the presence of black spots in different parts of the body in some infested fishes. While, internal organs were appeared anemic with enlargement and congestion. As well as, haemorrhage and ulceration of intestine and stomach mucous membrane, white nodules in posterior kidney. The isolated parasites from examined tilapia were 6 types namely: *Enterogyrus cichlidarum*, *Orientocreadium batrochoides*, *Heterophidae*, *Polyonchobothrium sp*, *Paracamallanus cyathopharynx* and *Acanthocentis tilapiae*. Helminth infestations of *O. niloticus* in Sidi Salem district fish farms in autumn season were 11 , 8, 1 and 4 % trematodes , nematode , cestode and *Acanthocentis tilapiae* respectively. Also, in Alirad district fish farms were 9 , 4, 1 and 2 % respectively. While, in Meutobeus fish farms were 6 , 3 , 1 and 2 % respectively. The residues of cadmium in water and *O. niloticus* tissues naturally exposed to cadmium were determined and discussed. The correlation between naturally exposed to cadmium *O. niloticus* tissues and internal parasitic diseases was studied. Also, cadmium displayed a significant decrease in PCV%, RBCs and Hb while elevation in the level of WBCs , blood glucose , serum AST, ALT, urea and creatinine at Sidi Salem district fish farms decreased in Alirad district fish farms and Metobus District fish farms throughout the periods of study. Besides, the histopathological alterations in different organs of *O. niloticus* were recorded.

[Eissa, I.A. M.; Mona, S. Zaki; Noor El Deen, A I E and Ibrahim, A Z. and Osman, K. Abdel Hady **Field Study on Cadmium pollution in relation to internal parasitic diseases in cultured Nile Tilapia at Kafr El-Sheikh Governorate.** Journal of American Science 2011;7(4):650-660]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Key words:** cadmium, *O. niloticus*, internal parasites, histopathology, clinicopathology

### 1. Introduction

Today, the contamination of freshwater with a wide range of pollutants has become a matter of great concern over the last few decades. Heavy metal levels have increased due to domestic, industrial, mining and agricultural activities (Kalay and Canli, 2000). Aquatic organisms such as fish and shellfish accumulate metals to concentrations many times higher than present in water (Olaifa *et al.*, 2004). They can take up metals concentrated at different levels in their different body organs. Cadmium concentration is higher in gills and viscera than other organs (Khaled, 2004). Studies carried out on fish have shown that cadmium heavy metal may have toxic effects, altering physiological activities in tissue and in blood of fish (Larsson *et al.*, 1985). Therefore, it is important to monitor heavy metal in aquatic environments (water and fish). Now, there is more awareness of the importance of studying fish parasites as one of the major obstacles in fish production about 80% of fish diseases are parasitic especially for warm water fish

(Eissa *et al.*, 1996). The relationship of parasitism and pollution is not simple and essence involves a double edged phenomenon which parasitism may decrease host susceptibility to toxic pollutions may result in an increase or decrease in the prevalence of certain parasites. Pollutants may affect on intermediate or alternate hosts in parasite life cycle, on free-living life cycle stages of parasite invasion (Sindermann, 1990). This study was undertaken to investigate the levels of Cadmium heavy metal in water and *O. niloticus* fish in relation to internal parasitic diseases among Kafr El Sheikh fish farms

### 2. Materials and methods

#### 2.1. Fish:

A total number of 400 adult cultured *O. niloticus* were randomly collected from Kafr El- Sheikh Governorate fish farms. The collected fish were obtained in autumn season 2010 from three districts areas (Sidi-Salem, Alriad and Metobus fish farms). The length of adult specimens was 20 - 30 cm. While



as their average body weights were ranged from  $180 \pm 10$  g. The collected fish were transferred alive to lab of Hydrobiology Dept. in National Research Center in large plastic tanks filled with two thirds with their natural water from the same source and aerated with air battery pumps.

## 2.2. Water samples:

A total number of 36 water sample of 3 districts of cultured fish. They were collected from the same fish farms at the same time (midday). The collected water sample bottles were labeled with the locality, date, time and type of fish pond. The flasks, one litre volume were equipped with a cork stopper and open hand prides under water surface then equipped again. The water samples were collected as replicates from various distances along each location and the averages of their analysis were taken.

## 2.3. Aquaria:

Fourteen fully prepared glass aquaria,  $40 \times 50 \times 100$  cm were used for holding the collected fish throughout the period of study. They were supplied with a chlorine free tap water with continuous aeration using electric air pumping compressors (Rena, France) according to Innes (1966); without water filtration or water heater.

## 2.4. Clinical picture:

Alive fish were clinically examined and postmortem examination according to the methods described by Noga (1996).

## 2.5. Parasitological examination:

Musculature, gastrointestinal tract and internal organs were examined according to Paperna (1980).

## 2.6. Blood sampling:

It was collected from the caudal vein of the examined fish using a plastic syringe and divided into two portions. The first portion was kept as a whole blood in heparinized tubes for hematological examination. Serum was separated from the second portion for biochemical analysis according to Dacie & Lewis (1991).

## 2.7. Cadmium residues:

In liver, kidneys, and musculature were estimated according to Combs *et al.* (1987).

## 2.8. Histopathological examination:

Autopsy specimens were taken from liver, intestine, spleen, gills and musculature of fish in different groups and fixed in 10% formalin solution for 24 hrs. Washing was done in tap water then serial dilutions of alcohol (70, 90% and absolute ethyl) were

used for dehydration. Specimens were cleared in xylene and embedded in paraffin and sectioned 4 microns thickness by slide microtome. The obtained sections were collected on glass slides, deparaffinized, stained by hematoxylin and eosin and examined microscopically (Banchroft and Stevens, 1996).

## 3. Results

### 3.1. Clinical picture:

*O. niloticus* exposed to cadmium showed slimy body with pale skin, signs of restlessness, some fish suffered from emaciation. Also, abnormal movement and shape (**scoliosis**) were shown with loss of appetite and escape reflex. Postmortem lesions revealed inflamed, enlarged pale spleen and liver spotted with inflammatory patches, while the intestines were darker in colour (**Plate.( A):( 1 to 4 )**).

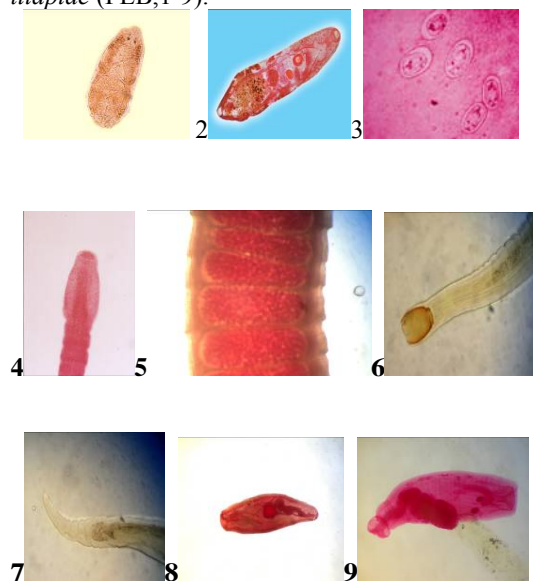


**Plate.( A):** Showing *O. niloticus* naturally exposed to Cadmium suffering from emaciation (1), **scoliosis** (2), degeneration in ovaries (3) enlarged pale spleen and spotted liver with inflammatory patches (4).

### 3.2. Parasitological examination:

Adult worms were isolated from the stomach of infested fish. Such adult worms are trematodes belonged to class Trematoda, order Monogenea, and genus *Enterogyrus* and identified as *Enterogyrus cichlidarum*. They were isolated from midgut of infested fish adult worms are related to class Trematoda, order Digenea and genus *Orientocreadium* and identified as *Orientocreadium batrochoides*. Cysts were embedded in musculature as black colour, oval in shape with thin double wall cyst. They were related to Heterophid metacercariae. Adult worms were isolated from the intestine of infested *O. niloticus* as small whitish in colour, segmented and flat. Such adult worms belonged to subclass Eucestoda order Pseudophyllidea, family Ptychobothriidae, genus *Polyonchobothrium*. Concerning the

parasitological examination it was revealed funnel shape and armed with large tridents with sclerotized posterior ends, the worm is yellowish in colour when fresh, the buccal capsule was chitinous. Such adult worms belonged to order Spiruridea, family Camallanidae, genus *Paracamallanus* and identified as *P. cyathopharynx*. Thorny-head worms were isolated from hindgut. Such adult worms were belonged to phylum Acanthocephala, class Eoacanthocephala, order Gyraacanthocephala, family Quadrogyridae, genus *Acanthosentis* and identified as *Acanthosentis tilapiae* (PLB,1-9).



**Plate. (B):** Showing *Enterogyrus cichlidarum* wet mount (1), Adult fluke, *Orientocreadium batrochoides*. (2), heavy infestation of *Heterophidae* encysted metacercariae in musculature (3), *Polyonchobothrium* sp. (Anterior end). Wet mount (4), *Polyonchobothrium* sp. (gravid segment) (5), *Paracamallanus cyathopharynx*. (Anterior end). Wet mount (6), *Paracamallanus cyathopharynx*. (Posterior end). Wet mount X 10. (7): *Acanthosentis tilapiae* ♂. (8): *Acanthosentis tilapiae* ♀. (9) All stained with acetic acid alum Carmine X 40 except wet mount one.

### 3.3. Prevalence of internal parasitic diseases in *O. niloticus*

From **Table (1)** it was indicated that a great variation in the infestation % in adult *O. niloticus* naturally exposed to cadmium.

Helminth infestations of *O. niloticus* in Sidi Salem district fish farms, trematodes were 11 %, nematode was 8 %, cestode was 1 %, *Acanthosentis tilapiae* were 4 % in autumn season. Also, Helminthes infestations of *O. niloticus* in Alirad district fish farms, trematodes were 9 %, nematode

were 4 %, cestode were 1 %, *Acanthosentis tilapiae* were 2%. While, Helminthes infestations of *O. niloticus* in Meutobeus fish farms, trematodes were 6 %, nematode were 3%, cestode were 1%, *Acanthosentis tilapiae* were 2% in autumn season (Table,2).

**Table( 1): - Prevalence of parasitic infestation in adults *O. niloticus* naturally exposed to cadmium in relation to different localities.**

Locality	No of Fish	Number of infested Fish		Total
		No	%	
Sidi Salem fish farms	200	48	24	12
Alirad fish farms	100	16	16	4
Meutobeus fish farms	100	12	12	3
<b>Total</b>	<b>400</b>	<b>76</b>		<b>19</b>

### 3.4. Cadmium residues in water :

Results are shown in **Tables 4&5** (Cadmium concentrations in water of Nile Tilapia farms).

### 3.5. Cadmium residues in *Oreochromis niloticus* tissues:

Results are shown in **Table 5** (Concentration of cadmium in fresh Nile tilapia tissues). Cadmium residues were significantly increased in internal organs of *O. niloticus* tissues comparing to musculature.

### 3.6. Hematological studies:

The present study demonstrated that *O. niloticus* naturally exposed to cadmium displayed a significant decrease in P.C.V, RBCs and Hb while elevation in the level of WBCs at Sidi Salem district fish farms these parameters were decreased in Alirad and Meutobeus Districted fish farms throughout the periods of study (Table 6 and 7) .

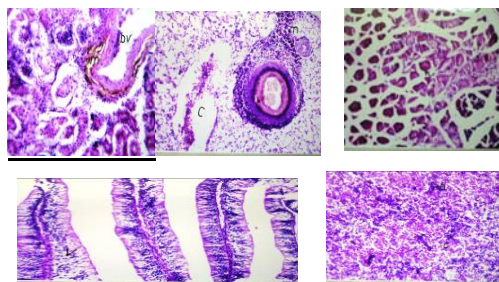
### 3.7. Biochemical studies:

The present study demonstrated that *O. niloticus* naturally exposed to cadmium displayed a significant elevation in the level of blood glucose, serum AST, ALT, UREA, Creatinine. at Sidi Salem district fish farms these parameters were decreased in Alirad and Meutobeus Districted fish farms throughout the periods of study (Table 8).

### 3.8. Histopathological examination:

The histopathological alterations in the affected liver was manifested as melanin pigmented cells with leucocyte inflammatory cells infiltration were observed in the portal vein associated with

congestion in the central vein.while in the affected kidney was manifested as focal haemorrhage in between the degenerated and necrosed tubules associated with dilatation and congestion in the blood vessels with perivascular deposition of melanin pigmented cells .also, in the affected musculature was manifested as hyalinization in some muscular bundles. Oedematus musculature and infested with encysted metacercariae were appear surrounded with serous fluid which contain a network of fibrin and in the affected intestine was manifested as hypertrophy, hyperplastic, proliferation and necrobiosis in the lining epithelium associated with inflammatory cells infiltration in the lamina propria. There was Variations were observed in the thickness of the villi , while the goblet cells were observed in diffuse manner all over the mucosal epithelium . The histopathological alteration in the affected spleen was manifested as hemosiderin was detected in the congested red pulps ,focal melanin pigment cells deposition was observed in the white pulps and in the perivascular tissue of the dilated and congested blood vessels(PL.C,1-5).



**Plate.(C):** Showing Liver of *O.niloticus* naturally exposed to Cadmium suffered from melanin pigmented cells and leucocyte inflammatory cells infiltration (m) were observed in the portal area associated with congested central vein © (1), kidney suffered from degeneration in the tubules with dilatation in the blood vessels (bv) (2), hyalinization in some muscular bundles (3), necrobiosis in the mucosal epithelium with inflammatory cells infiltration (v) of villi. (4) and hemosiderin (h) and congested red pulps © (5) . All stained by (H& E) X 40.

Table (2): The correlations between the average of some water parameters in different fish cultures with endoparasitic infestations.

District	No of Exam. fish	No of Infested. fish	Type of parasites	Infestation		Total	
				No	%	No	%
Sidi Salem fish farms	200	48	Trematodes	22	11	22	5.5
			Cestodes	2	1	2	0.5
			Nematodes	16	8	16	4
			Acanthocephala	8	4	8	2
Alirad fish farms	100	16	Trematodes	9	9	9	2.25
			Cestodes	1	1	1	0.25
			Nematodes	4	4	4	1
			Acanthocephala	2	2	2	0.5
Meutobeus fish farms	100	12	Trematodes	6	6	6	1.5
			Cestodes	1	1	1	0.25
			Nematodes	3	3	3	0.75
			Acanthocephala	2	2	2	0.5

Table (3) : Cadmium concentrations in water of Nile Tilapia farms (three localities).

Metal	District	In Autumn season water samples (ppm)		
		Min.	Max.	Mean ± SE
Cadmium	Sidi Salem fish farms	0.13	0.62	0.35± 0.009
	Alirad fish farms	0.062	0.082	0.07± 0.002
	Meutobeus fish farms	0.01	0.07	0.04± 0.015

Table (4): Residue of Cadmium in different *Oreochromis niloticus* tissues :

samples location	Musculature			Liver			Spleen			Kidney		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Sidi Salem fish farms	0.052	0.092	0.072±0.05	0.085	0.095	0.09±0.02	0.049	0.058	0.054±0.02	0.035	0.049	0.036±0.02
Alirad fish farms	0.026	0.046	0.036±0.05	0.053	0.073	0.063±0.02	0.007	0.0097	0.009±0.03	0.0086	0.0098	0.009±0.02
Meutobeus fish farms	0	0	0	0.008	0.01	0.009±0.02	0.007	0.0095	0.009±0.02	0.005	0.009	0.007±0.02

Table (5): Residue of Cadmium in different fish tissues correlated to internal parasitic infestation.

samples location	Musculatures	Liver	Spleen	Kidney	Infested fish %	
					NO	
Sidi Salem fish farms	0.072±0.05	0.09±0.02	0.054±0.02	0.036±0.02	48	24
Alirad fish farms	0.036±0.05	0.063±0.02	0.009±0.03	0.009±0.02	16	16
Meutobeus fish farms	0	0.009±0.02	0.009±0.02	0.007±0.02	12	12

Table (6): Erythrogram ( RBCs (10<sup>6</sup>) , Hb and P.C.V.) in naturally exposed *O. niloticus* to cadmium pollution in three different locations in Kafr El Sheikh Governorate fish farms (10 samples from each location).

Districts	Parameters	Control fish		Naturally exposed fish	
		Range	mean	Range	Mean
Sidi Salem fish farms	R.B.Cs (10 <sup>6</sup> )	1.7 -1.9	1.8 ±0.08Aa	1.6 -1.7	1.65±0.07Cb
	Hb(g%)	8.3-8.6	8.45±1.45Ba	6.6-7.4	7±2.75Aa
	P.C.V%	19.5-22.5	21±2.22Ab	16-18.5	17.25±2.75Ab
Alirad fish farms	R.B.Cs (10 <sup>6</sup> )	1.7-1.8	1.75 ±0.07Bb	1.8 -1.9	1.85±0.08Aa
	Hb(g %)	8.1-8.4	8.22±1.22Ca	7.1-8.2	7.65±1.65Cb
	P.C.V%	19-21	20±2.10Bb	20.5-23	21.75±2.15Ca
Meutobeus fish farms	R.B.Cs (10 <sup>6</sup> )	1.75-1.85	1.8 ±0.08Aa	1.7-1.75	1.725±0.05Bb
	Hb(g %)	8.3-8.8	8.55±1.55Aa	7.9-8.7	8.3±1.13Bb
	P.C.V%	20-22.5	21.5±2.15Ab	21-23.5	22.25±2.12Ba

For the same parameter of different locality under study:-

Capital letters: Means within the same column of different letters are significantly different at (P < 0.05).

Small letters: Means within the same row of different letters are significantly different at (P < 0.05).

Table (7): Leukogram parameter ( total WBCs and differential count ) in naturally exposed *O. niloticus* to cadmium pollution in three different locations in Kafr El Sheikh Governorate fish farms (10 samples from each location).

Districts	Parameters	Control fish		Naturally exposed fish	
		Range	mean	Range	Mean
Sidi Salem fish farms	W.B.Cs (10 <sup>3</sup> )	40-44	42±2.40Ab	108-116	112±12.11Aa
	Heterophiles%	3.35-4	3.75±3.15Bb	25.1-27.3	26.5±2.65Aa
	Agranulocytes%	95-98	96.25±2.65Ba	70.3-75.1	73.5±7.33Cb
Alirad fish farms	W.B.Cs (10 <sup>3</sup> )	38-40	39±2.39Cb	48-54	51±5.11Ca
	Heterophiles%	4.25-4.65	4.5±0.45Ab	8-8.40	8.25±5.22Ba
	Agranulocytes%	90-98	95.5±5.62Ca	90-92.15	91.25±9.25Bb
Meutobeus fish farms	W.B.Cs (10 <sup>3</sup> )	40-42	41±4.11Bb	52.5-57.5	54±4.53Ba
	Heterophiles%	2.75- 3.25	3±3.14Cb	5.1-5.85	5.75±1.75Ca
	Agranulocytes%	95-99	97±7.98Aa	92.3-96.35	94.25±4.25Ab

For the same parameter of different locality under study:-

Capital letters: Means within the same column of different letters are significantly different at (P < 0.05).

Small letters: Means within the same row of different letters are significantly different at (P < 0.05).



Table, (8): Biochemical parameters in naturally exposed *O. niloticus* to cadmium pollution in three different locations in Kafr El Sheikh Governorate fish farms (10 samples from each location)

District	Parameters	Control fish		Naturally exposed fish	
		Range	Mean	Range	Mean
Sidi Salem fish farms	AST(u/l)	88-94	91±9.11Bb	126-146	136±11.36Aa
	ALT (u/l)	18-27	22.5±2.25Bb	37-43	40±4.11Aa
	Urea(mg/dl)	2.9-3.45	3.175±0.03Ab	3.8-4.5	4.15±0.04Aa
	Creatinine(mg/dl)	0.68-0.97	0.74±0.07Ab	0.8-1.3	1.05±0.05Aa
	Glucose(mg/dl)	58-63	60.5±6.50Bb	71-93	82±8.12Aa
Alirad fish farms	AST(u/l)	90-96	93±9.3Ab	120-136	128±12.18Ba
	ALT (u/l)	18-23	20.5±2.05Cb	33-42	37.5±3.75Ba
	Urea(mg/dl)	2.7-3.33	3.015±0.03Aa	2.8-3.7	3.25±0.03Ba
	Creatinine(mg/dl)	0.63-0.68	0.65±0.06Bb	0.63-1.1	0.85±0.08Ba
	Glucose(mg/dl)	60-62	61±6.11Ab	67-73	73±7.3Ba
Meutobeus fish farms	AST(u/l)	84-93	88.5±8.55Bb	96-107	103.5±10.37Ca
	ALT (u/l)	20-28	24±4.22Ab	19-33	26±2.66Ca
	Urea(mg/dl)	2.15-2.85	2.5±0.02Ba	2.3-3.1	2.7±0.02Ca
	Creatinine(mg/dl)	0.71-0.78	0.74±0.07Ab	0.54-1.1	0.82±0.08Ba
	Glucose(mg/dl)	57-64	60.5±6.05Bb	63-69	66±6.16Ca

For the same parameter of different locality under study:-

Capital letters: Means within the same column of different letters are significantly different at ( $P < 0.05$ ).

Small letters: Means within the same row of different letters are significantly different at ( $P < 0.05$ ).

#### 4. Discussion

In Egypt, some areas especially those of Kafr El-Sheikh Governorate, fish farms are depending on agriculture drainage water mixed with industrial and the phosphate fertilizer which is considered the main source of Cd in the environment (Osman, 2009). Both types are considered an important source of cadmium pollution affecting the prevalence of internal parasitic diseases in cultured fishes similar to recorded by Dimari *et al.* (2008). The present study deals with most of different internal parasitic diseases among naturally infested cultured *O. niloticus* in relation to the cadmium concentration in water in Kafer El- Sheikh fish farms. In this work, the main clinical picture in naturally infested *O. niloticus* revealed that some aggregated on the water surface, accumulated at the water inlet of the pond. Also, some fish showed abnormal movement and shape (scoliosis). The results in this investigation showed that cadmium can primarily cause the backbone deformities in fish due to musculature spasms. This result is in agreement with that reported by Olsson (1998). Also, loss of appetite and escape reflex. These signs may be nearly similar to that recorded by Noga (1996) and Eissa *et al.* (2010). These results may be attributed to the prolonged exposure to heavy metals resulted in respiratory, osmoregulatory and circulatory impairment. The internal organs of naturally infested fish appeared pale, anemic with enlargement of liver and spleen and distended gallbladder. Signs of emaciation with petechial haemorrhage on the surface

of abdomen and slight bulging of stomach was observed, while intestinal wall was congested with the presence of ulcer and protruded from anus accompanied with large amount of catarrhal mucoid secretion. These may be nearly similar to that recorded by Ibtsam (2004) and Osman (2005). This may be explained due to the presence of trematodes, nematode, cestode or thorny headed worms which cause harmful effect as they embedded themselves between the villi of intestine causing local damage to the intestinal mucosa and possibly peritonitis. Proteolytic enzymes may be discharged from some adult worms degrading the intestinal tissues (Woo, 1995).

Regarding the internal monogenea (*Enterogyrus cichlidarum*) they were morphologically and parasitologically described and were nearly similar to the descriptions given by Osman (2005) and Noor El Deen (2007). Adult flukes isolated from midgut (*Orientocreadium batrochoides*) was identified depending on the morphological and parasitological characters and the encysted metacercariae, were identified as (Heterophidae). These findings are nearly similar that recorded by Yamaguti (1985). Concerning to the cestodes it was identified as (*Polyonchobothrium sp.*). Such identification is nearly similar that recorded by Ibtsam (2004).

Regarding to the isolated nematodes from naturally *O. niloticus*, isolation and identification of *Paracamallanus cyathopharynx* were undertaken that nearly similar to those of original descriptions by Woo (1995). Finally, the morphological and



parasitological examinations of Tilapia fish revealed isolation and identification of *Acanthosentis tilapiae* whose descriptions are nearly similar to those of original description by Yamaguti, (1985) and Ibtam, (2004).

In the present study a total prevalence of helminth infestations of *O. niloticus* in Sidi Salem district fish farms represented trematodes as 11% , nematode 8 % , cestode 1 % and *Acanthosentis tilapiae* 4 % in autumn season.

Such results are lower than recorded by Osman (2005) who found a prevalence of Enteroglyosis as 67.2%. These variations may be attributed to the water quality criteria and age of fish as such worms are stomach flukes need aged fish have well developed stomach and its wall was thicker for adaptation and fixation for such parasite. These results higher than that recorded with Hassan (1992) who found prevalence as 6% in *O. niloticus*. Such result disagree with that recorded by Tawfik (2005) who recorded a prevalence of digenia in autumn 22.7%. These results may be attributed to different types of fish, the presence of intermediate host (snails), the suitable temperature which consider the main survival factors for these intermediate hosts and aquatic birds (piscivorous birds) according to Noor El Deen (2007). Concerning a total prevalence of *P. cyathopharynx* was 8 % from *O. niloticus*. These findings disagree with that met by Abd El- Wahed (1992) who recorded a prevalence of *P. cyathopharynx* was 1.4% in *O. niloticus*. These results may be attributed to different types of fish, the presence of intermediate host copepods and the suitable temperature. In this study, *Polyonchobothrium* sp could be detected with an prevalence 1 % from *O. niloticus*. These findings are lower than that recorded by Hassan (1992) who found 7.5%. These results disagreed with that recorded by Nadia Mahfouz (1991) who recorded a prevalence of nematodes infestation in autumn were 0% . These differences may be due to variation in climatic and ecological factors which affect on intermediate host copepods (Cyclops) and aquatic birds.

Finally, the prevalence of *Acanthosentis tilapiae* in cultured *O. niloticus* was 4 %. These findings nearly higher than with that recorded by Rawia Adawy (2000) who recorded a prevalence of *A. tilapiae* in cultured two Tilapia sp as 2.4 and 3.7% and lower than that recorded by Eid (1997) who recorded 37.8% in tilapia sp. Also, disagree with Bassiony (2002) who mentioned that the highest infestation rate a prevalence of *A. tilapiae* in cultured Tilapia sp was in autumn 16.2 %. Also, Ibtam (2004) in cultured tilapia sp in autumn season as 10 %. This result may be attributed to different types of fish the presence of intermediate host (amphipod and isopod), the suitable

temperature which consider the main survival factors for these intermediate host.

Cadmium concentration in water of Sidi Salem farms was  $0.35 \pm 0.009$  ppm which higher than the maximum permissible limits recommended by WHO (1984) 0.005 ppm, FAO/WHO (1992) [0.05 ppm] and Egyptian Organization for Standardization and Quality Control "E.O.S.Q.C". [0.1 mg kg<sup>-1</sup>]. This result may be attributed to presence of industrial activity and agriculture drench branches were supply Sidi Salem fish farms .While in Alrad and Metobus areas were  $0.07 \pm 0.002$  and  $0.04 \pm 0.015$  ppm respectively within the permissible limits. This result may be attributed to absence of industrial activity.

It was observed that cadmium concentration in liver, kidney, intestine and spleen was significantly higher in fish exposed to cadmium. While cadmium concentration was in the permissible limits in musculature. The high contents of heavy metal found in viscera may be due to the fact that most of the heavy metal are accumulated in the liver, spleen, intestine and kidney after ingestion. Khaled, (2004) reported that Cadmium is stored in the body in various tissues but the main site of accumulation in aquatic organisms is in the kidney and liver. Fish musculature is important part to be used for human consumption. This result recorded with Yilmaz (2003) who found that concentrations of heavy metals were higher in all internal organ samples than in muscles.

The results recorded elevation of internal parasites with increase of Cd pollution comparing with that observed in control one. The relationship of parasitism and pollution is not simple and essence involves a double edged phenomenon which parasitism may decrease host susceptibility to toxic pollutions may result in an increase or decrease in the prevalence of certain parasites. Pollutants may affect on intermediate or alternate hosts in parasite life cycle, on free-living life cycle stages of parasite invasion (Sindermann, 1990).

Regarding hematological and biochemical parameters, a decrease in the concentration of haemoglobin in blood, which is usually caused by the effect of toxic metals on gills, as well as a decrease in oxygen also indicates anaemia that confirms negative changes occurring in fish. Glucose is one of the most sensitive indices of the stress state of an organism: its high concentrations in blood indicate that the fish is in stress and it is intensively using its energy reserves i.e. glycogen in liver and muscles. Meanwhile, a decreased concentration of glucose indicates the exhaustion of energy (glycogen) resources and, subsequently, the worsening of an organism status. Namely, a decrease in glucose in the blood of fish is observed during long-term exposure to heavy metals.

The present study demonstrated that *O. niloticus*

naturally exposed to cadmium revealed a decrease in RBCs count (erythropenia) ( $1.65 \pm 0.07 \times 10^6$ ) while Hb ( $7 \pm 2.75$  g %) and P.C.V% ( $17.25 \pm 2.75$ ) in Sidi salim district area at Cd level (0.35 ppm). While RBCs count ( $1.85 \pm 0.08 \times 10^6$ ), Hb ( $7.65 \pm 1.65$  g %) and P.C.V% ( $21.75 \pm 2.15$ ) in Alriad districted area at Cd level (0.07 ppm). In Metabus district area, RBCs count ( $1.725 \pm 0.05 \times 10^6$ ), Hb ( $8.3 \pm 1.13$  g %) and P.C.V% ( $22.25 \pm 2.12$ ) at Cd level (0.04 ppm). The later 2 areas displayed nearly similar level with the finding net with control levels. This may be attributed to their water supply coming directly from Rasheed branch. Regarding Sidi salim district area its water supply coming directly from agriculture and industrials discharges. These results are similar with observations reported by Osman (2009) and Mona Zaki *et al* (2010).

However, an increase in WBCs count (leukocytosis) ( $112 \pm 12.11 \times 10^3$ ) and heterophilis ( $26.5 \pm 2.65\%$ ), while a decrease in agranulocytes ( $73.5 \pm 7.33\%$ ) in comparing to control in Sidi salim district area at Cd level (0.35 ppm). The results shown in Alriad district area at Cd level (0.07 ppm) concerning WBCs count ( $51 \pm 5.11 \times 10^3$ ), heterophilis ( $8.25 \pm 5.22$ ) and agranulocytes ( $91.25 \pm 9.25\%$ ). In Metabus district area, concerning WBCs count ( $54 \pm 4.53 \times 10^3$ ), heterophilis ( $5.75 \pm 1.75\%$ ) and agranulocytes ( $94.25 \pm 4.25\%$ ). This result is nearly similar to control. It may be attributed to the increase of cadmium level in Sidi Salim than Alriad and Metabus districts. These results are nearly similar to what recorded by Gill and Pant (1986) and Ahmed (1996) who recorded that the lymphocytosis condition may be occur due to the stimulatory effect of cadmium on haematopoietic tissues.

The present study showed that the exposure of cadmium was observed an elevation in the blood glucose ( $82 \pm 8.12$  mg/dl), serum AST and ALT ( $136 \pm 11.36$  and  $40 \pm 4.11$  u/l) in Sidi salim district area respectively. While the glucose, AST and ALT ( $73 \pm 7.3$  mg/dl,  $128 \pm 12.18$  and  $37.5 \pm 3.75$  u/l) in Alriad district area respectively and in Metabus district area, the glucose, AST and ALT ( $66 \pm 6.16$  mg/dl,  $103.5 \pm 10.37$  and  $26 \pm 2.66$  u/l) respectively. These results in agreement with Mona Zaki *et al.*, (2010) who reported that experimental exposure of *Tilapia zillii* to cadmium sulphate at 0.25 ppm. Several investigations showed that these blood enzymes were highly increased in the fish treated with cadmium. In addition, Shakoori *et al.* (1990) who reported that the increase of blood enzymatic activity is either due to leakage of these enzymes from hepatic cells and thus raising levels in blood, increased synthesis and enzyme induction of these enzymes. Also, Campbell *et al.* (1984) who reported that these enzymes liberate to the blood stream when the hepatic parenchyma cells

are damaged Thophon *et al.* (2003) who found structural and ultrastructural damage in the liver of rainbow trout and white Sea bass following cadmium exposure. These results are nearly similar to what recorded by Attef, (2005) who reported that the fish *O. niloticus* exposed to sublethal concentration of cadmium displayed a significant elevation in the level of blood glucose after one day till the end of the experimental period.

Regarding the naturally exposed fish to cadmium revealed an increase of glucose level may be attributed to stress. Also, De Smet and Bulst, (2002) who observed an increase in the activities of AST and ALT and they suggested that the observed proteolysis is intended to increase the role of protein in the energy production during cadmium stress. The results indicated that cadmium produces severe toxic effects in fish blood.

In the present study, in naturally exposed fish to cadmium was observed an elevation in the serum urea ( $4.15 \pm 0.04$  mg/dl) and Creatinine ( $1.05 \pm 0.05$  mg/dl) in Sidi Salim district area at Cd level (0.35 ppm) while the serum urea ( $3.25 \pm 0.03$  mg/dl) and Creatinine ( $0.85 \pm 0.08$  mg/dl) in Alriad district area at Cd level (0.07 ppm) and Metabus district area, the serum urea ( $2.7 \pm 0.02$  mg/dl) and Creatinine ( $0.82 \pm 0.08$  mg/dl) at Cd level (0.04 ppm). These results in agreement with Mona Zaki *et al.* (2010) who reported that experimental exposure of *Tilapia zillii* to cadmium sulphate at 0.25 ppm induced deleterious effects in fish such as damage of Kidney, liver, spleen and gills, which were reflected on the biochemical and hematological parameters. Also, this result agree with Abbas *et al.*, (2002) and Mona Zaki *et al.*, (2010) who recorded that a significant increase of urea and Creatinine of *Tilapia zillii* exposure to cadmium sulphate at 0.25 ppm.

Histopathologically, the liver showed degeneration of the hepatocytes, congestion of central vein and nuclear pyknosis in the majority of hepatic cells. These findings were apparent as the liver considered the organ of detoxification. Similar results were observed by Van Dyk (2007) who found that liver of fish is sensitive to environmental contaminants because many contaminants tend to accumulate in the liver and exposing it to a much higher levels than in the environment. In this study, the intestine of *O. niloticus* showed, hypertrophy and hyperplastic proliferation of intestinal villi, severe dilatation of blood vessels of the sub mucosa and desquamation of the epithelial lining of the interstitial villi attributed to mechanical injury of the infested parasites and the effect of toxic product. These findings are nearly similar to that recorded with Ibtisam (2004). Concerning histopathological alteration in the affected kidney was manifested as focal haemorrhage in

between the degenerated and necrosed tubules associated with dilatation and congestion in the blood vessels with perivascular deposition of melanin pigmented cells. The results of this investigation related to the kidneys of fish that were purposely poisoned. These results may be similar to that recorded with Tanimoto *et al.* (1999) who recorded that cadmium causing pathological changes of kidney tubules. Similar alterations in musculatures and kidney of Tilapia were observed in several species of fish exposed to heavy metals and these alterations were described by Gupta and Srivastava (2006). Regarding histopathological alteration in the affected musculature was manifested as hyalinization in some muscular bundles. Oedematus musculature and infested with encysted metacercariae were appear surrounded with serous fluid which contain a network of fibrin. These results may be attributed to cadmium pollution. This may be similar to that recorded with Kaoud and El-Dahshan (2010) who recorded that that several histopathological alterations were seen in the muscles of Tilapia which included degeneration in muscle bundles with aggregations of inflammatory cells between them and focal areas of necrosis. Also, atrophy and edema of muscle bundles as well as splitting of muscle fibers. The pathological findings in the intestine included atrophy in the muscularis, degenerative and necrotic changes in the intestinal mucosa and submucosa with necrotized cells aggregated in the intestinal lumen, edema and atrophy in the submucosa.

Finally, regarding histopathological alteration in the affected spleen was manifested as hemosiderin was detected in the congested red pulps and focal melanin pigment cells deposition was observed in the white pulps and in the per vascular tissue of the dilated and congested blood vessels. These observations in agreement with that recorded by Pirarat *et al.* (2008) who observed histopathological change in the spleen of *Oreochromis niloticus* fish exposed to different concentration of cadmium. Histopathological change including ellipsoidal tissue enlargement, melanomacrophage cell aggregation, vacuolar degeneration and edematous capillary and also with Suresh (2009) who observed a significant difference in the frequency and size of melano macrophage centres (MMC) and free macrophage found in, spleen of *Tilapia mossambica* exposed to 20.93 mg l<sup>-1</sup> of cadmium chloride and observed also two pigments hemosiderin and melanin.

From the present study, it was concluded that, scoliosis in *O. niloticus* may be an indicator to cadmium pollution and there was a positive correlation between cadmium pollution in water and the prevalence of internal parasitic infestation in *Oreochromis niloticus*. Finally, cadmium residues in

musculature was found in the permissible limits, while in internal organs were relatively high.

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## New proposed prevertebral approach for turned on normal contralateral C7 as a donor for avulsed brachial plexus

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**Abstract: Background:** Great progress of surgical treatment had been made in brachial plexus injuries during recent two decades, however, there are still more challenges. It needs more advancing and a lot of work from surgeons and neurosurgeons. **Aim:** To propose a new surgical approach for neuritization of avulsed brachial plexus (BP). **Methods:** Anatomical study by dissection of the brachial plexuses on both sides in 6 male cadavers in five steps. **Results:** The mean value of the length of C7 ( $5.73\text{cm} \pm 0.12$ ) was significantly longer than that of C5, C6, C8 and T1 on both sides. Complete C7 length in step 4 with prevertebral approach ( $8.95\text{ cm} \pm 0.04$ ) was significantly longer than that of C7 in step 3 with subcutaneous tunnel ( $7.00\text{ cm} \pm 0.11$ ,  $P < 0.001$ ). Moreover, in proposed procedure 5 (with turning of the complete C7 root from behind the vertebral artery to the medial side of the artery) was significant excesses of the length of complete C7 ( $0.68\text{ cm} \pm 0.07$ ) when compared with that of proposed procedure 4 and procedure 3 ( $-0.25\text{ cm} \pm 0.02$ ,  $-8.95\text{ cm} \pm 0.04$ ,  $P < 0.001$ ). **Conclusion:** We proposed by cadaveric dissection a new passageway for turned on complete C7 to neuritize affected Bp just in front of the vertebral column, and we proved the statistical significance of this approach. Moreover, after complete release of C7 from turning around vertebral artery the neuritization will be very lax with extra length.

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**Keywords:** brachial plexus, Nerve graft, prevertebral.

### 1. Introduction

The brachial plexus is composed of a complex network of nerves, passing from the neck to the axilla, which supplies motor, sensory and sympathetic fibers to the upper limb. It is formed by the union of the ventral rami of the lower four cervical nerves and the greater part of the ventral ramus of the first thoracic nerve <sup>[1-3]</sup>.

The number of severe brachial plexus injuries requiring proper management has increased over the past several years, largely in part to improved prehospital emergency, and advanced life support techniques <sup>[4]</sup>. In spite of increased experience in the management of these severe brachial plexus injuries (BPI), there remains considerable challenge in dealing with these devastating injuries <sup>[1, 5, 6]</sup>.

The overall target of reconstruction should be directed toward regaining of many important functions of the upper extremity (i.e., shoulder stability, elbow flexion, elbow extension, protective sensation in the hand and if feasible, hand reanimation <sup>[1]</sup>).

It is well known that, the best results in brachial plexus surgeries are achieved when directly suturing proximal stump of ruptured rootlet with its distal stump or using shorter bridge graft between them <sup>[7]</sup>.

Total root avulsion injuries of the brachial plexus considered irreparable. For these cases and in a

period of denervation less than 1 year, nerve transfer is used to innervate the affected arm <sup>[8,9]</sup>.

Donner nerves for reinnervation of total root avulsion injuries are always insufficient <sup>[10]</sup>. Many donor nerves had been used for brachial plexus innervations, like phrenic <sup>[11, 12]</sup>, spinal part of accessory <sup>[13]</sup>, intercostal <sup>[14]</sup> nerves, and motor branches of the cervical plexus <sup>[15]</sup>.

Gu et al. <sup>[16]</sup> used the contralateral C7 nerve root as a donor. He divided his work in 2 stages; firstly, he elongated the root by sural nerve graft. After that, he resected the neuroma and transferred the sural graft to selected recipient nerves.

The gross anatomy of the brachial plexus is well known, but the internal anatomy especially that of C7 is seldom mentioned. Narakas <sup>[17]</sup> published a scheme for cross sectional localization of C7 and its distribution to the posterior cord of the brachial plexus, median, pectoral, musculocutaneous and ulnar nerves.

Slingsluff et al. <sup>[18]</sup> presented a detailed and advanced quantitative microanatomy of the brachial plexus in human. According to his work, main contributions from C7 to lateral cord (44%) and to posterior cord (44%). C7 fibers to lateral cord were mainly sensory to median nerve. C7 fibers to posterior cord were mostly motor to the radial nerve.

The most important muscles with a C7 contribution do not have C7 as their single or dominant innervation. On this base, the usage of normal contralateral C7 is safe as a donor for reinnervation<sup>[18]</sup>.

As stated before that, the major challenge with avulsions is the lack of adequate proximal intraplexus donors (roots) in continuity with the spinal cord<sup>[1]</sup>. Therefore, the aim of our study is to propose a shorter approach to neuritize avulsion injuries of the brachial plexus from contralateral C7 root.

## 2. Material and Methods:

Six male formalin-fixed adult Egyptian cadavers used in this work. All measurements made using 1) a protractor to define the distance between points, 2) a Diamond Master Vernier Calipers to measure the distances and 3) an orthopedic goniometer. We dissected on the brachial plexuses of both sides in them in five steps.

- First step: Deep dissection of posterior triangle and cutting of the omohyoid muscle and scalenus anterior were done. Then, we measured the length of each root from side of vertebral column to the level of formation of the trunks in right and left sides.
- Second step: Dissection of the whole C7 root as we call it, (it is composed of C7 root, middle trunk, and the divisions of middle trunk until their junction with lateral and posterior cords) done and measured.
- Third step: Turning of the complete contralateral C7 root in front of pretracheal strap muscles as a model for subcutaneous tunnel done, and the distance from the end of the turned complete c7 and contralateral plexus measured denoting graft length required.



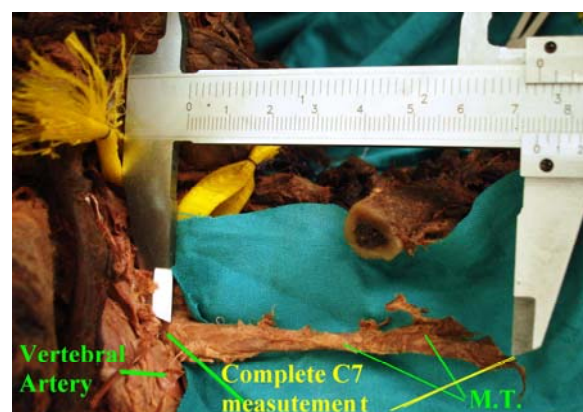
**Fig.1: Photograph showing roots measurement.**

- Forth step: In present study we proposed prevertebral retroesophageal tunnel for cross innervation from C7 to contralateral brachial plexus. Therefore, we had turned on the complete C7 root on itself to lie just in front of the vertebral column.
- Fifth step: After removal of the transverse process of C6, and turning of the complete C7 root from behind the vertebral artery in the same tunnel (prevertebral retroesophageal).
- \* In step 2, we compared the length of C7 roots in step 1 and the complete C7 (c7 root + middle trunk + divisions of the middle trunk).
- \* In step 3, we estimate the desirable cable graft length that needed to connect the complete C7 to contra lateral BP.
- \* In step 4, we measured the length needed for these roots to reach contralateral plexuses in minus numbers.
- \* In step 5, we measured the overriding length of these roots on contralateral plexuses in plus numbers.

## Statistical analysis:

Statistical analysis performed using the 18.0 version of SPSS statistical software for windows (SPSS Inc. Chicago, IL, USA). All data expressed as mean  $\pm$  SE (Standard error). Student's *t* test: Unpaired *t* test used to compare means of different groups, and paired *t* test to compare means of same groups. Analysis of variance (ANOVA of F test): For comparison of means of more than two groups used also.

For all above statistical tests, P value of  $>0.05$  indicates non-significant results, and P value of  $<0.05$  indicates a significant results.



**Fig.2: Photograph showing complete C7 measurement.**



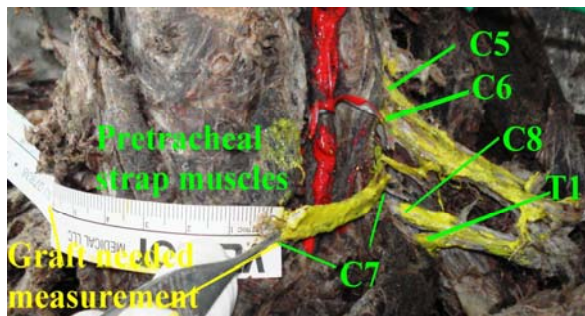


Fig.3: Photograph showing proposed subcutaneous tunnel.

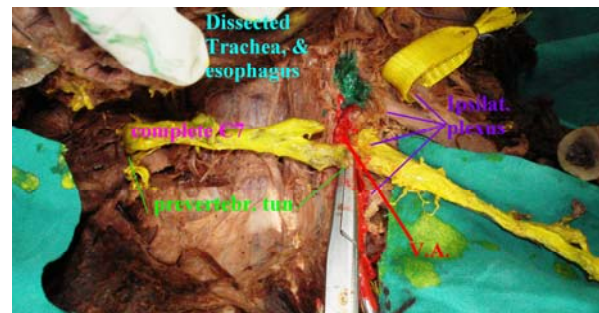


Fig.4: Photograph showing proposed prevertebral approach.



Fig.5: Photograph showing estimated length of graft in step 4

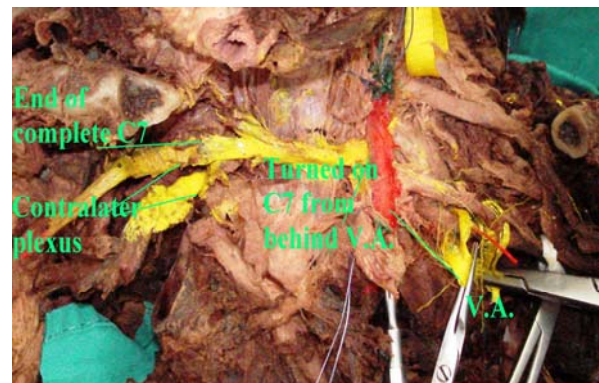


Fig.6: Photograph showing bypassing the turning around vertebral artery.

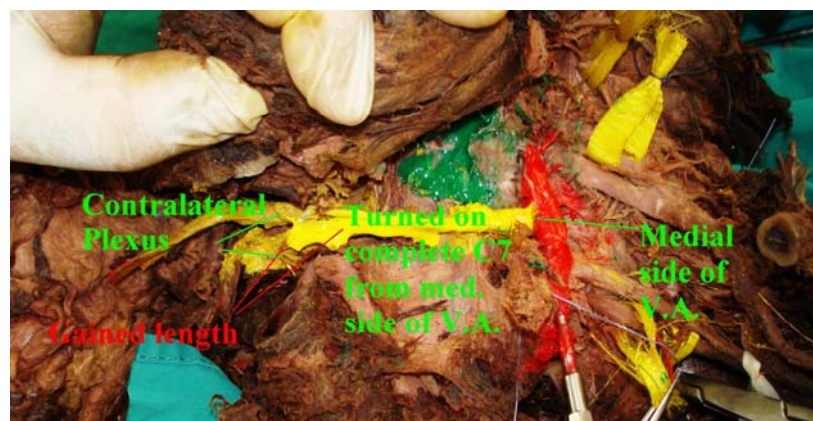


Fig.7: Photograph showing step 5 with extra length.

### 3. Results

Table (1) shows the length of the dissected roots (C5, C6, C7, C8, and T1), from side of the vertebral column level to the level of formation of the trunks. It was found that, there were no significant differences between the right and left sides in the length of any dissected roots ( $P > 0.05$ ).

Table (2) and figure (8) show comparison between the mean values of the length of C7 (mean  $\pm$  SE) and that of other roots in both right and left sides. It was found that the mean values of the length of the

right C7 ( $5.73 \pm 0.12$ ) was significantly longer than that of C5, C6, C8 and T1 ( $4.4 \pm 0.25$ ,  $4.12 \pm 0.07$ ,  $3.7 \pm 0.19$  and  $4.05 \pm 0.19$  respectively) ( $P < 0.01$ ,  $P < 0.001$ ,  $P < 0.001$  and  $P < 0.001$  respectively). The same significance was found also in the left side. The length of the left C7 root ( $5.70 \pm 0.13$ ) was significantly longer than that of C5, C6, C8 and T1 ( $4.35 \pm 0.21$ ,  $4.15 \pm 0.110$ ,  $3.67 \pm 0.18$  and  $4.02 \pm 0.20$  respectively, ( $P < 0.001$ ).

Table (3) and figure (9) identify the comparison between the mean values of the complete

C7 length (mean  $\pm$  SE) and that of C7<sub>2</sub>. It was clear that complete C7 length ( $8.95 \pm 0.04$ ) was significantly longer than that of C7 ( $7.00 \pm 0.11$ ,  $P < 0.001$ ).

Table (4) and figure (10) represent the comparison between the length needed in step 3, 4 &

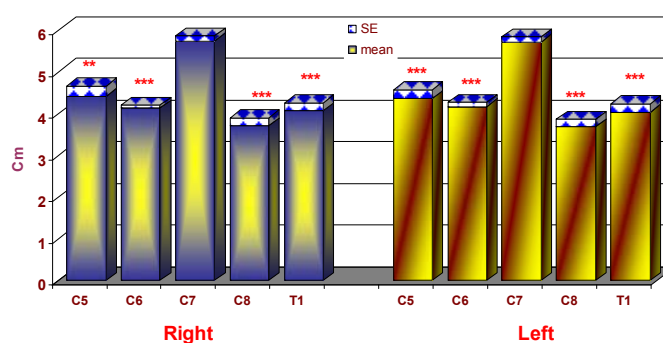
5 to reach contralateral BP. It was found that, in proposed procedure 5 we had significant excess of the length ( $0.68 \pm 0.07$ ) when compared with that of proposed procedure 4 and procedure 3 ( $-0.25 \pm 0.02$ ,  $-8.95 \pm 0.04$ ,  $P < 0.001$ ).

**Table 1: The length of each dissected root from intervertebral level to the level of formation of the trunks.**

N= 6	Mean $\pm$ SE		P value
	Right	Left	
C5	$4.4 \pm 0.25$	$4.35 \pm 0.21$	0.363 (NS)
C6	$4.12 \pm 0.07$	$4.15 \pm 0.11$	0.679 (NS)
C7	$5.73 \pm 0.12$	$5.70 \pm 0.13$	0.363 (NS)
C8	$3.7 \pm 0.19$	$3.67 \pm 0.18$	0.363 (NS)
T1	$4.05 \pm 0.19$	$4.02 \pm 0.20$	0.175 (NS)

**Table 2: Comparison between the mean values of the length of C7 ( $\pm$  SE) and the length of other roots in both right and left sides.**

N= 6	Right (Cm)	t test VS C7	Left (Cm)	t test VS C7
<b>C7</b>	$5.73 \pm 0.12$		$5.70 \pm 0.13$	
<b>C5</b>	$4.4 \pm 0.25$	$4.822^{**}$ ( $P < 0.01$ )	$4.35 \pm 0.21$	$5.343^{***}$ ( $P < 0.001$ )
<b>C6</b>	$4.12 \pm 0.07$	$11.610^{***}$ ( $P < 0.001$ )	$4.15 \pm 0.11$	$9.076^{***}$ ( $P < 0.001$ )
<b>C8</b>	$3.7 \pm 0.19$	$9.175^{***}$ ( $P < 0.001$ )	$3.67 \pm 0.18$	$8.994^{***}$ ( $P < 0.001$ )
<b>T1</b>	$4.05 \pm 0.19$	$7.507^{***}$ ( $P < 0.001$ )	$4.02 \pm 0.20$	$7.054^{***}$ ( $P < 0.001$ )



**Figure 8: A histogram illustrates the comparison between the mean values of the length of C7 ( $\pm$  SE) and the length of other roots in both right and left sides.**

**Table 3: Identifies the comparison between length of C7 and complete C7.**

N=6	Step 1	Step 2
$\bar{X}$	7.00	8.95
SE $\pm$	0.11	0.04
t test	$22.709^{***}$	
P value	$< 0.001$	

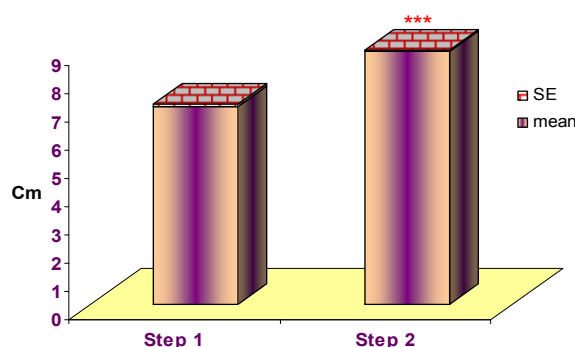


Figure 9: A histogram illustrates the comparison between length of C7 and complete C7.

Table 4: Demonstrates the length needed in step 3, 4 & 5 to reach contralateral sides.

N=6	Step 3	Step 4	Step 5
$\bar{X}$	-8.95	-0.25	0.68
SE $\pm$	0.04	0.02	0.07
F	P < 0.001		
P of LSD VS step 3	P < 0.001		P < 0.001
P of LSD VS step 4			P < 0.001

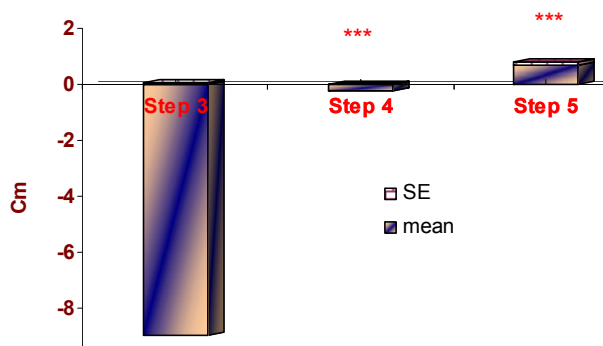


Figure 10: Illustrates the length needed in step 3, 4 & 5 to reach contralateral sides.

#### 4. Discussions

Neurotization techniques were introduced at earlier times in the twentieth century, giving hope for the restoration of severe brachial plexus injuries<sup>[19]</sup>. This initial surgical enthusiasm, unfortunately, gave way to a more pessimistic attitude of “wait and see,” as almost all of these earlier surgical techniques were unsuccessful in restoring limb function. A nonoperative approach was eventually advocated for all brachial plexus injuries at that time<sup>[20]</sup>.

Introduction of the art of microsurgery in peripheral nerve problem and the establishment of the principle of tension free repair brought several new approaches to brachial plexus reconstruction, especially when dealing with supraclavicular lesions with multiple avulsions<sup>[21,22]</sup>. A variety of extraplexus motor and sensory donors has been advocated to neurotize selected functions in order to achieve restoration of the performance of the shoulder, elbow, and hand. Yeoman and Seddon<sup>[23]</sup> introduced later neurotization of the



musculocutaneous nerve with intercostal nerve transfer. In addition, use of branches of the ipsilateral cervical plexus<sup>[24]</sup>, contralateral lateral pectoral nerve<sup>[25]</sup>, accessory nerve<sup>[26]</sup>, hypoglossal nerve, phrenic nerve and contralateral C7<sup>[26,27]</sup> selective contralateral C7<sup>[28,29]</sup>, and selective ulnar nerve to musculocutaneous has been championed by different researchers<sup>[30]</sup>.

Restoration of functional finger flexion and extension has remained largely unobtainable dream following avulsion injuries. The prolonged time required for nerve regeneration results in prolonged muscle denervation that lead to muscle atrophy and subsequent fibrosis, leaving the muscles inadequate to generate the force required to move the fingers<sup>[1]</sup>.

The experimental work of Carlstedt<sup>[31]</sup> demonstrated that reimplantation of avulsed roots in spinal cord led to some improvement of muscle functions. In spite of that, functional outcome compromised due to severe cocontraction. Further experimental work needed before this approach can have any meaningful clinical application.

Whenever possible, the use of intraplexus motor donors for neurotizations is preferable. Intraplexus donors have a larger number of axons than gained from extraplexus sites, and thereby increase the chances for successful neurotization. The overall results from the study done by Terzis et al.<sup>[32]</sup> and analysis of clinical series of 204 operated cases, including 112 cases with multiple avulsions, demonstrated that intraplexus donors consistently yielded the strongest contractile force, regardless of the muscle target. So Extraplexus nerve transfers should be considered second choice alternatives. Allieu et al.<sup>[33]</sup> reported a 66% success rate for restoring elbow flexion following neurotization by intraplexus donors (C5 or C6). This was superior to neurotization with intercostals or the accessory using an interposition nerve graft. Other authors like Narakas and Hentz<sup>[34]</sup> considered plexoplexal transfers as far more reliable than extraplexal, and even superior to muscle transfers in the reconstruction of shoulder abduction, elbow flexion, or wrist extension. Kawai et al.<sup>[12]</sup> reported that the outcome was better in 80% of avulsion injuries treated with the combined use of intraplexus and extraplexus donors. We planned our proposal for the treatment of multiple avulsion cases of traumatic brachial plexus injury, not far from these whole ideas. We did plexoplexal neurotization from contralateral C7 by a new short tunnel, to gain the maximal plexal donors without deficits.

Long graft failures are a big problem in BP primary surgery. Hattori et al.<sup>[35]</sup> tried to solve this problem by the use of vascularized nerve grafts, i.e., vascularized ulnar based on the superior ulnar

collateral vessels. Such vascularized grafts are able to maintain their blood supply and have survived transfer even after being placed in a scarred bed. Moreover, the intraneural environment is optimally preserved and axonal carry-through would not compromise. Birch et al.<sup>[36]</sup> and Addas et al.<sup>[37]</sup> used the ulnar nerve as a vascular graft based on the whole ulnar artery, thereby sacrificing one of the main arteries to the hand. All of the results were more favorable as compared to conventional nonvascularized nerve grafting<sup>[1]</sup>. In other way and in our work we can preserve some function of ulnar and median nerves by doing plexoplexal neurotization in a short circuit. The rationale for our proposal depends on the following:

- 1- C7 root neither innervate any muscle as single nor as a dominant innervator, and so no deficit usually occurred after its' taking as donor.
- 2- The length and direction of C7 root is unique for cross innervation.
- 3- Prevertebral tunnel is short enabling us to do neurotization with minimal graft length.
- 4- If we add release of C7 from medial side of the vertebral artery, and avoiding the whole turn of C7 around the (V.A.), we will gain extra length making the neurotization more and more lax without any need for grafts.

It is clear that, anatomical studies performed on cadavers or in life surgery work. When carrying studies on cadavers, the surgeon has more time and range of actions while bleeding is quite minimal or even no. However, rigor, tissue decay, identification of small blood and lymph vessels and nerves, creates some discomfort<sup>[38]</sup>. On the other hand, surgeon does not feel this discomfort in operating room and he can use electrostimulation for identification of motor nerves under light relaxation of the patient. Therefore, we recommend following our work by many anatomical studies during life surgeries to gain previously mentioned merits. Moreover, to know more about avulsed roots, their positions, mobility, and pliability. Also after taking into the consideration that, the normal roots pass from behind in the anterolateral direction, which is different from avulsed roots, which may become more volar and medial.

## 5. Conclusion:

The use of intraplexus motor donors for neurotizations of traumatized BP is preferable. In cases of multiple avulsions of the roots, ipsilateral intraplexus donors are not available. Taking of contralateral complete C7 does not affect the normal upper limb. We proposed a new passageway for turned on complete C7 to neurotize affected Bp just in front of the vertebral column, and we proved after

cadaveric dissection statistically the significance of this approach. In addition, we added that, after complete release of C7 from turning around vertebral artery the neuritization will be very lax with extra length.

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## The Protective Effect of Green Tea Extract against Enrofloxacin Action on the Rat Liver; Histological, Histochemical and Ultrastructural studies

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**Abstract:** The bioavailability of enrofloxacin (EFX) was determined after single intraperitoneal administration to healthy adult albino rats. The aim of this trial was to evaluate, on what extent, the different doses of the green tea extract (GTE) as an antioxidant encompass a protective effect on the toxicity of EFX. Consequently, the study was carried out in three groups as follows: group 1, control animals; group 2, rats medicated only with daily dose of 75mg/kg enrofloxacin for 10 days and group 3, rats receive daily dose of 75mg/kg enrofloxacin and green tea extract for the same period (10 days). The last group was divided into three subgroups; subgroup A, received EFX of the concluding dose plus 1% GTE, subgroup B, received EFX of the same dose plus 1.5% GTE and subgroup C, received EFX of the similar dose plus 3% GTE. After the experimental period, small pieces of the liver tissue were taken and prepared for purpose of the histological, histochemical and electron microscopical examination. The results revealed that enhancement of EFX produces sever alterations in the hepatic tissue. It ascribed disturbances in hepatic architecture besides liver cells appeared hypertrophy correlated with necrotic nuclei. Congested blood sinusoids with leucocytic infiltration were apparent. Hepatocytes induced poor glycogen storage and exhausted proteins. Ultrastructural study demonstrated scattered cytoplasmic organelles after the destructed cell membrane from the burst down of the cell. GTE supplementation partially repairs the toxic effect of EFX and ameliorates the hepatic tissue especially when consumed by higher doses. Cytoplasmic glycogen and protein come again too increased. The fine structure manifested more or less intact hepatocytes through restored organelles constituents especially numerous profiles of granular endoplasmic reticulum, few lysosomes, normal glycogen deposits, euchromatic nuclei and distinct nucleoli as well as few lipid droplets in the cytoplasm. It was concluded that GTE is an important appropriate anti-oxidant improving the EFX toxicity at the altitude of the different doses however more improvement was observed after the consumption of higher ones.

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**Keywords:** Green tea, Enrofloxacin, rat Liver, Histology, Histochemistry, Ultrastructure.

### 1. Introduction:

Enrofloxacin a fluorinated quinolone carboxylic acid derivative is a chemotherapeutic agent use in human and veterinary medicine (Gorla et al., 1999). Its activity as antibacterial drugs against aerobic and anaerobic bacteria is essentially due to the effective inhibition of DNA replication by binding and inhibiting its synthesis (Elmas et al., 2001; Turel, 2002). Besides, Vaccaro et al. (2003) reported that the EFX seems to be inhibitor to cytochrome P450. Furthermore, quinolones were found to induce singlet oxygen and superoxide anion (Abd-Allah et al., 2000). It was demonstrated that the bacteriostatic activity of the tetracyclines at which enrofloxacin belonged is associated with inhibition of protein synthesis that is to be dependant on the time and the drug concentrations (Scholar and Pratt, 2000). The mechanism of its activity is preventing DNA supercoiling and decantation of original chromosomes to replicates (Turel, 2002). Moreover, it believed that in the presence of the magnesium metal ion, interact efficiently with gyrase

or the gyrase-DNA complex leads to an unstable condensation of the DNA configuration of the bacterial DNA molecule during cell division ( Lecomte et al., 1998; Sissia et al., 1998; Michiels et al., 2002; Noble and Maxwell, 2002 ; Xu et al., 2006).

Due to the potential antioxidant of green tea that is far greater than of vitamin E and/or C (Wiseman, 1997 and Rice-Evans, 1999), a number of different studies have been attributed including prevention liver and kidney injury induced by drugs and toxic agents. It improve the hepatic metabolism and intestinal absorption and cancer prevention (Yan et al., 2006; Walle, 2007), used for ameliorates acute lung inflammation after exposure to cigarette smoke (Lanzetti et al., 2008; Chan et al., 2009) and improve fenitrothion insecticide toxicity (Elhalwagy et al., 2008). However, several repots have been suggests that catechins is responsible for the most effective property in the inhibition of lipid peroxidation (Ishikawa et. al., 1997) and it react with peroxyradicals in phospholipids

bilayers via a single electron transfer followed by deprotonation (Javanovic et al., 1996).

The aim of the present work is to evaluate the effects of green tea extract against toxicity induced by antimicrobial agent, enrofloxacin 10%. Green tea has been attributed as a potent anti-oxidant, so we thought to study the improvement occur in the liver after consuming of different doses of the extract. It was investigated by means of histological, histochemical and ultrastructural methods.

## 2. Material and Methods

### 1- Chemicals and drugs:

China green tea (Kangra, Himanchal Pradesh, India and Lipton-Unilever, Englewood Cliffs, NJ, USA) of commercially available market was purchased locally packaged by the Egypt National Native Product sources. Enrofloxacin 10% manufactured and purchased from the local company; El-Nasr pharmaceutical chemicals Co., Egypt.

### 2- Preparation of green tea:

Green tea extract was freshly prepared everyday by brewing (25-30 gm) dried tealeaves in 500 ml of boiling water then cooled to room temperature. Tealeaves solution was filtered and extracted second time with 500 ml of boiling water then filtered. The two filtrates were combined to obtain 3% green tea extract (3g tealeaves /100 ml water), in that case, it poured into the animals' feeding bottles. 1.5 % and 1% green tea extract prepared by the identical method (Khan et al, 2009). The resulting clear solution is similar to tea consumed by human. All animals were given a solution of green tea extract instead of drinking water.

### 3- Animals and experimental design:

Adult male rats (*Rattus norvegicus*), (3–4) months age, weighing 100 -120 g, obtained from the National Research Center in Dukki, Cairo (N.R.C.) were placed in wire mesh cages and housed in usual situation temperature ( $25 \pm 2^{\circ}\text{C}$ ) with a relative humidity and a 12h light/ dark cycle. All animals were acclimatized for 1 week before the experiment, fed natural diet and given fresh water ad libitum. The animals were randomly divided into groups (5 per group) and kept in separate cages.

Group 1: (Control) animals received no specific treatment.

Group 2: Animals were injected intraperitoneally with enrofloxacin 10% (75 mg/kg B. W.) daily for 10 days to provoke the damage effects on the liver.

Group 3: Animals were injected intraperitoneally with enrofloxacin10% (75 mg/kg B. W) daily for 10 days and feed with green tea extract to identify its

protective effects on the liver. This group was divided into three subgroups as following:

Subgroup A: Animals were injected intraperitoneally with enrofloxacin10% (75 mg/kg B. W) daily and feed with 1% green tea extract in stead of drinking water.

Subgroup B: Animals were injected intraperitoneally with enrofloxacin10% (75mg/kg B. W) daily and feed with 1.5 % green tea extract in stead of drinking water.

Subgroup C: Animals were injected intraperitoneally enrofloxacin10% (75 mg/kg B. W) daily and feed with 3% green tea extract in stead of drinking water.

### Histological study:

After rats were killed small pieces of liver were removed and fixed by means of 10 % buffered neutral formalin. The specimens were dehydrated and cleared afterward embedded in paraffin blocks. Paraffin sections were cut with at  $5\mu$  thickness and stained with routine hematoxylin and eosin (H &E) stain and Crossmon's trichrome technique for evaluating the collagen fibrosis.

### Histochemical study:

In parallel, histochemical finding was established by means of PAS reaction for glycogen stored and bromophenol blue method for detection of proteins in both controls the treated animals ( Bancroft and Stevens, 1990).

### Ultrastructural study:

Small pieces of liver were fixed in 2% glutaraldehyde fixative in 0.1M Na- cacodylate buffer, pH 7.2, followed by three washes in the buffer, then post fixed during 1 h in 1%OsO<sub>4</sub> in the same buffer, dehydrated, cleared and infiltrated in Resin. Ultrathin sections were stained with 2% uranyl acetate, followed by Reynold's lead citrate stain and examined with a Siemens ELMISKOP I or Zeiss M-109 Turbo electron microscope.

## 3. Results

**In control rat liver:** the hepatic tissue appeared normal microscopically, the central vein from its region, the hepatic cords were radiating and separated by the blood sinusoids (S) (Fig.1). The distribution of proteins in the hepatocytes (in faint blue colorations) was demarcated (Fig. 2).

The ultrastructural picture of the hepatic tissue in control rat liver revealed, normal hepatic cell euchromatic nucleus (N) with two normal nucleoli (n), numerous intact mitochondria(m), Golgi apparatus(G), granular endoplasmic reticulum profiles(ER), hepatocyte intact cell membrane(mem), primary lysosomes and glycogen deposits (Fig.3).



**Liver tissue after daily dose of enrofloxacin 10% and sacrifice after 10 days:** The hepatic tissue revealed severe ballooning degeneration of many hepatocytes and some of them were burst down and destructed or necrotic, central vein with perivenous leucocytic infiltration and congested blood sinusoids (Fig.4). After Crossmon's trichrome staining there was traces of collagenic stroma, congested blood vessels including the sinusoids, severe ballooning degeneration of the hepatocytes, that some of them were necrotic or destructed (Fig.5). A common vacuolization along with the hepatocytes swelling and ballooning due to hydropic degeneration and progress to focal necrosis in the course of the hepatic lobules and some degree of hepatic hyperatrophy. The liver showed established acute inflammatory cells and exudates were increased in these animals intoxicated with enrofloxacin.

No marked PAS +ve reaction in the hepatocytes due to deprived glycogen, a number of hepatocytes suffered from severe ballooning degeneration, others were destructed with pervascular leucocytic infiltration (Fig.6) in comparison to the control that showed no congestion in blood vessels, no leucocytic infiltration, normal distribution of glycogen (PAS +ve magenta colour) through the hepatocytes (Fig.7).

A depleted protein was induced from the hepatocyte cytoplasm even in some of the nucleoprotein of the hepatocyte nuclei (Fig.8) to be compared with the control of Fig. 2.

The electron microscopic picture exhibited ruptured hepatocyte after severe ballooning degeneration, and so its nucleus. A haemorrhagic area with oozing blood red blood corpuscles, scattered cytoplasmic organelles after the destructed cell membrane of the burst down of the cell was in attendance, (Figs.9 & 10).

So, it is likely to say that EFX given dose caused severe hepatic toxicity that was reflected by the all hazards manifested on the hepatocyte and hepatic blood stagnation in the liver tissue.

**Liver tissue of rats after daily dose of enrofloxacin 10% and 1% green tea extract:** The hepatic tissue showed no congestion of the blood sinusoids, many normal intact hepatocytes, less abundant leucocytic infiltration (Fig.11). After Crossmon's trichrome staining, there were few collagen fibril deposition (in green) in the hepatic stroma, (Fig.12), the hepatocytes took the same description of Fig.11.

Many hepatocytes deposit glycogen in their cytoplasm (magenta colour), (Fig.13).

By electron microscopy, there were intact hepatocytes with many normal mitochondria, slightly decreased granular endoplasmic reticulum profiles,

intact euchromatic hepatocytic nucleus with normal nucleolus, few primary lysosomes, normal Golgi complex few lipid droplets (p) and glycogen deposits, (Fig.14).

**Liver tissue of rats after daily dose of enrofloxacin 10% and 1.5% green tea extract:** The hepatic tissue appeared with no congestion of blood sinusoids, many normal intact hepatocytes, and prominent active von Kupffer cells in the blood sinusoids (Fig.15). The nuclei of the hepatocytes were more prominent clear with clearance of their nuclei. Little differences between it and that of 1% treatment were common.

Most of the hepatocytes revealed PAS +ve glycogen deposition (in magenta colour), no congestion of blood vessels including the sinusoids and very few numbers of necrotic hepatocytes, due to ameliorating effect of green tea extract (Fig.16).

The electron microscopic picture exhibited hepatocytes with intact cell membrane, many normal intact mitochondria, few necrotic or destroyed hepatocytes, euchromatic nuclei of normal hepatocytes, normal granular endoplasmic reticulum profiles and glycogen deposits, with few lipid droplets (Fig.17).

**Liver tissue of rats after daily dose of enrofloxacin 10% and 3% green tea extract:** The hepatic tissue demonstrated that most of the hepatocytes to be normal with vesicular nuclei and normal nucleoli, no vascular including sinusoidal congestion, no leucocytic infiltration (Fig.18). It was verified that the cytoplasm became more eosinophilic and the nuclei became more prominent with recovered nuclei i.e., they were improved in comparison to the enrofloxacin given rats. It was noticed also that there is still necrotic cells present and slight vacuolation compared to the enrofloxacin alone. There were no differences between the normal control and green tea extract given groups.

Many of the hepatocytes deposited intracytoplasmic glycogen (Magenta colour), but few ones were not (Fig.19). The protein content of the hepatocytes nearly was restored to be more or less as those of control (Fig. 20).

With the electron microscopic manifestation there were more or less intact hepatocytes with restored organelles' constituents especially numerous profiles of granular endoplasmic reticulum, few lysosomes, normal glycogen deposits, euchromatic nuclei and distinct nucleoli as well as few lipid droplets in the cytoplasm of some hepatocytes (Fig.21) as those of controls, no expanded blood sinusoids (Fig.22). Those improved picture of the hepatic tissue is suggested to be due to the amelioration effect of green tea extracts at those short periods.

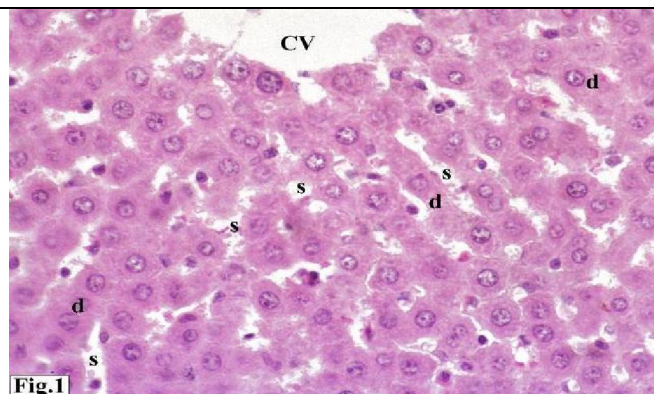


Fig.1: Photomicrograph for control rat liver displaying the central vein (C), hepatic cords (d) and blood sinusoids (S). H&E stain, X400.

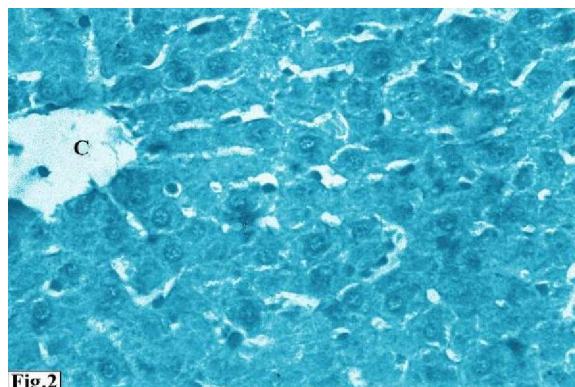


Fig.2: Photomicrograph for control rat liver distribution of proteins in the hepatocytes (in faint blue colouration), central vein(c), hepatic cords separated by blood sinusoids. Bromophenol blue stain, X 400.

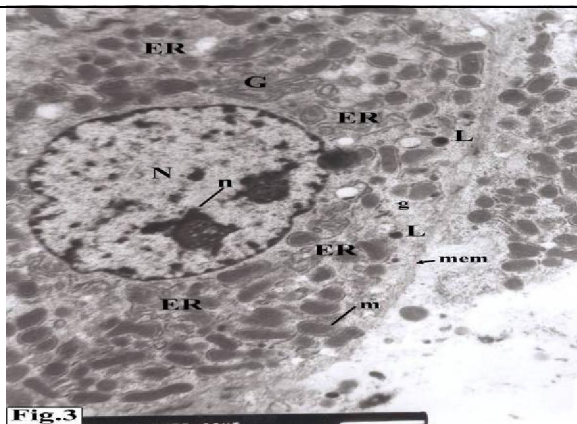


Fig.3: Electron micrograph for a control liver of rat, displaying, normal hepatic cell euchromatic nucleus (N) with two normal nucleoli (n), numerous intact mitochondria(m), Golgi apparatus(G), granular endoplasmic reticulum profiles(ER), hepatocyte intact cell membrane (mem), primary lysosomes, glycogen deposits(g), X 8000.

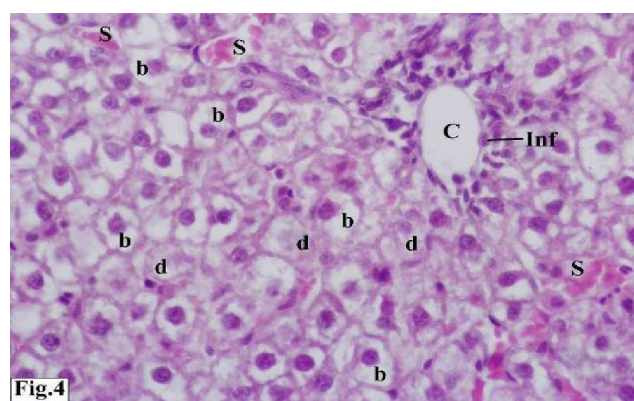


Fig.4: Photomicrograph for a section in the liver of rat administered daily dose of enro-floxacin 10% (75 mg/Kg B.W.) and sacrificed after 10 days of injection, displaying severe ballooning degeneration of many hepatocytes (b) and some of them were burst down and destroyed or necrotic (d), central vein (c) with perivenous leucocytic infiltration (inf), congested blood sinusoids (s). H & E stain, X400.

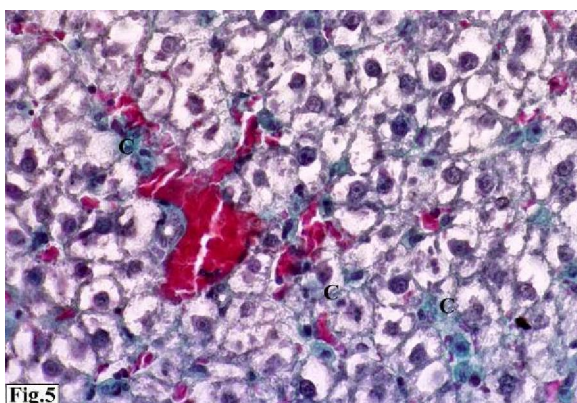


Fig.5: Photomicrograph for a section in the liver of rat administered daily dose of enro-floxacin 10 % (75 mg/Kg B.W.) and sacrificed after 10 days of injection, displaying stroma (c), congested blood vessels including the sinusoids, severe ballooning degeneration of the hepatocytes, that some of them were necrotic or destroyed as in Fig.3, Crossmon's trichrome stain, X400.

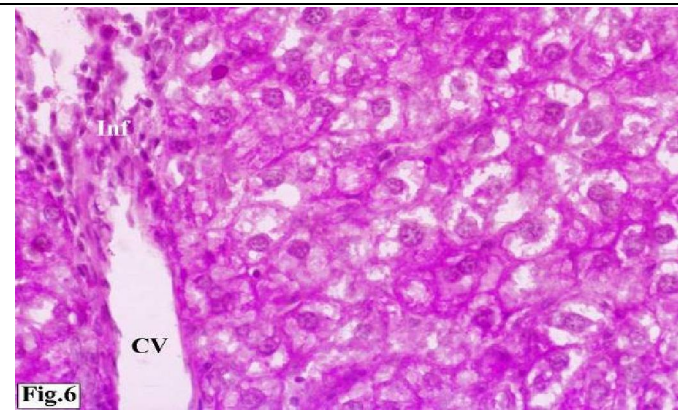


Fig.6: Photomicrograph for a section in the liver of rat, administered daily dose of enro-floxacin 10% (75 mg/Kg B.W.) and sacrificed after 10 days of injection, depicted no marked PAS +ve reaction in the hepatocytes due to deprived of glycogen, numerous of the hepatocytes suffered from severe ballooning degeneration, others were destroyed, perivascular leucocytic infiltration, PAS technique, X400



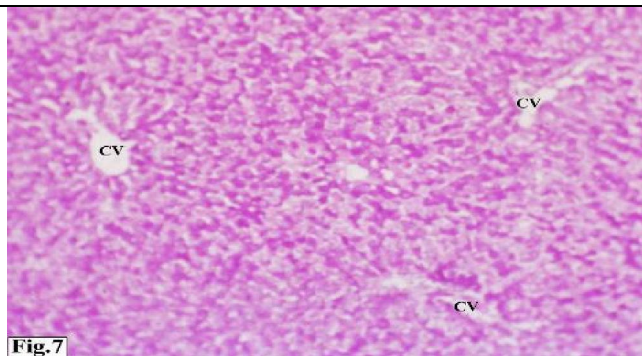
**Fig.7**

Fig.7: Photomicrograph for a section in a control rat liver for comparison of glycogen distribution in the hepatocytes with those of Fig.6, displaying no congestion in blood vessels, no leucocytic infiltration, normal distribution of glycogen (PAS +ve magenta colour) through the hepatocytes, PAS technique, X100.

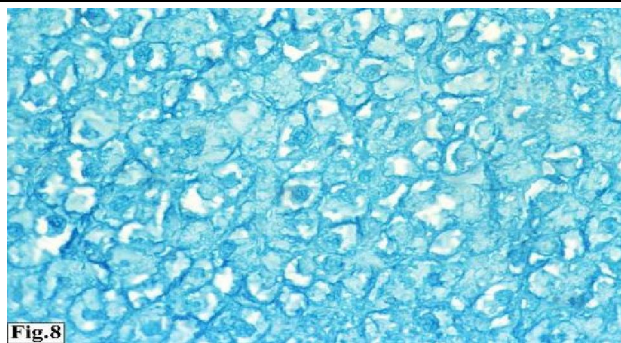
**Fig.8**

Fig.8: Photomicrograph for a section of rat liver administered daily dose of enro-floxacin 10 % ( 75 mg/Kg B. W.) and sacrificed after 10 days of injection, displaying depleted proteins from the hepatocyte cytoplasm even some of the nucleoprotein of the hepatocyte nuclei., to be compared with the control of fig. 2. Bromophenol blue stain, X400.

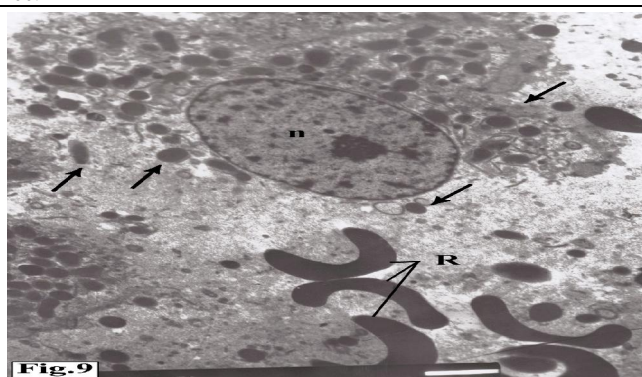
**Fig.9**

Fig.9: Electron micrograph for a section in the rat liver administered daily dose of enrofloxacin 10 % ( 75 mg/Kg B.W.) and sacrificed after 10 days of injection, displaying ruptured hepatocyte after severe ballooning degeneration, its nucleus (N), haemorrhagic area with oozing blood red blood corpuscles (R), scattered cytoplasmic organelles (arrows) after the destroyed cell membrane after the burst down of the cell, X 6000.

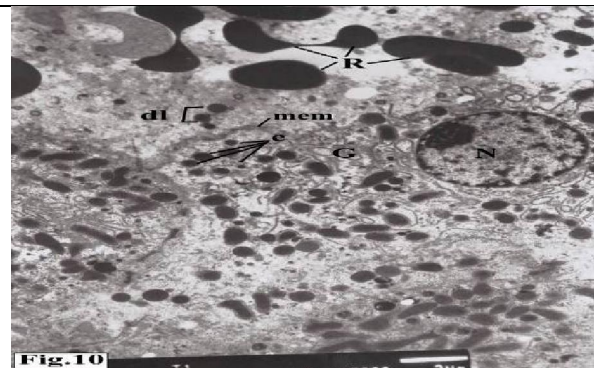
**Fig.10**

Fig.10: Electron micrograph for a section in the rat liver administered daily dose of enrofloxacin 10 % ( 75 mg/Kg B.W.) and sacrificed after 10 days of injection ,displaying haemorrhagic spot with oozing red blood corpuscles (R) destructed cell membrane (mem) of burst down hepatocyte, abnormal hepatocyte configuration, discarded lysosomes (dl) Golgi app. configuration (G), atrophied cell nucleus (N), X 6000.

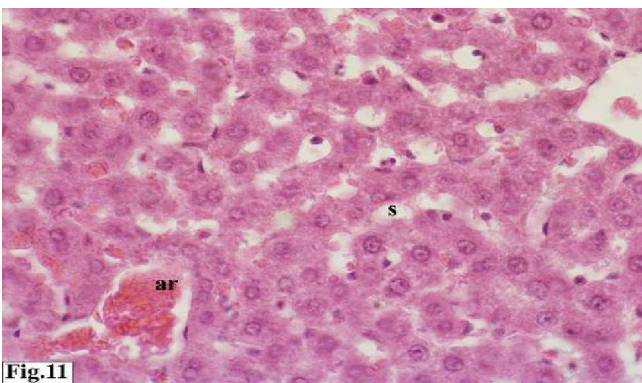
**Fig.11**

Fig.11: Photomicrograph for a section in the rat liver administered enrofloxacin 10% as daily dose as well as green tea extract(1%) instead of drinking water for continuous 10 days, then the rats were sacrificed, displaying, no congestion of the blood sinusoids(S), many normal intact hepatocytes , less abundant leucocytic infiltration. H & E stain, X400.

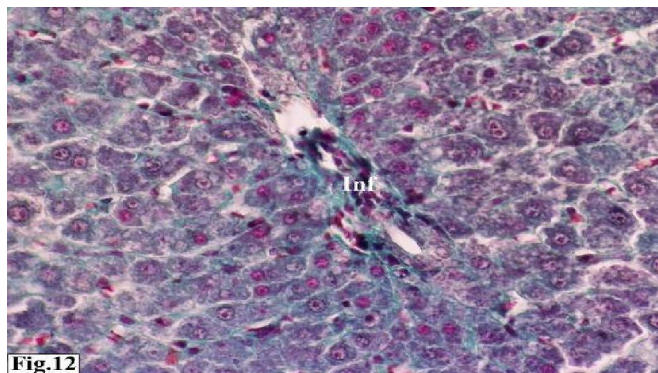
**Fig.12**

Fig.12: Photomicrograph for a section in the rat liver administered enro-floxacin 10% as daily dose as well as green tea extract(1%) instead of drinking water for continuous 10 days, then the rats were sacrificed, displaying few collagen fibril deposition(in green) in the hepatic stroma, the hepatocytes took the same description of Fig.11, Crossman's trichrome stain, X400.



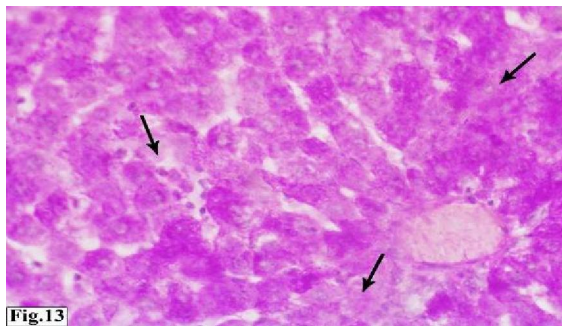


Fig.13

Fig.13: Photomicrograph for a section in the rat liver administered enrofloxacin 10% as daily dose as well as green tea extract (1%) instead of drinking water for continuous 10 days, then the rats were sacrificed, displaying no congestion in the hepatic sinusoids, less leucocytic infiltration in the portal tract, few necrotic or degenerated hepatocytes (arrows), many hepatocytes deposit glycogen in their cytoplasm (magenta colour). PAS technique, X400.

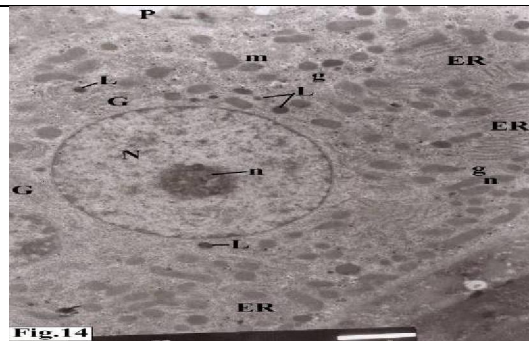


Fig.14

Fig.14: Electron micrograph for a section in the liver of rat administered daily dose of enrofloxacin 10% (75 mg /Kg B.W.) as one dose as well as green tea extract 1% instead of drinking water for continuous 10 days, then the rats were sacrificed, displaying, intact hepatocyte with many normal mitochondria (m), slightly decreased granular endoplasmic reticulum (ER) profiles, intact euchromatic hepatocytic nucleus (N) with normal nucleolus (n), few primary lysosomes (L), Golgi complex (G), few lipid droplets (p), glycogen deposits (g), X8000.

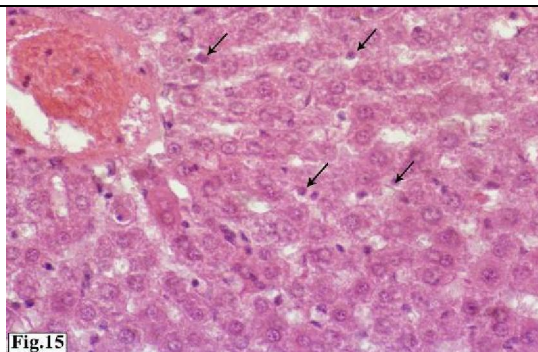


Fig.15

Fig.15: Photomicrograph for a section in the rat liver administered daily dose of enrofloxacin 10%(75 mg/Kg B.W) as well as green tea extract 1.5% instead of drinking water for continuous 10 days, then the rats were sacrificed, displaying, no congestion of blood sinusoids, many normal intact hepatocytes, few number of degenerated hepatocytes, prominent active von Kupffer cells (arrows) in the blood sinusoids. H & E stain, X400.

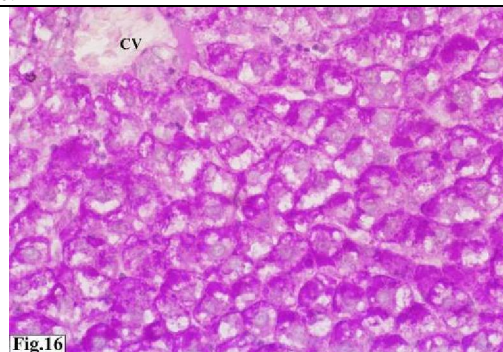


Fig.16

Fig.16 Photomicrograph for a section in the rat liver administered daily dose of enrofloxacin 10%(75 mg/Kg B.W) as well as green tea extract 1.5% instead of drinking water for continuous 10 days, then the rats were sacrificed, concealed most of the hepatocytes revealed PAS +ve glycogen deposition (in magenta colour), no congestion of blood vessels including the sinusoids, very few number of necrotic hepatocytes, due to ameliorating effect of green tea extract. PAS-technique, X400.

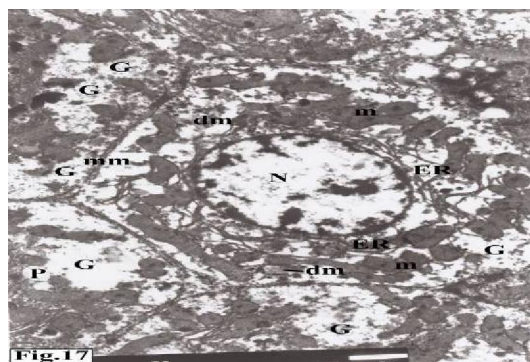


Fig.17

Fig.17: Electron micrograph for a section in the liver of rat administered daily dose of enrofloxacin 10 %(75 mg/Kg B.W.) as one dose as well as green tea extract 1.5% instead of drinking water for continuous 10 days, then the rats were sacrificed, displaying hepatocytes with intact cell membrane (mem), many normal intact mitochondria(m), few necrotic or destroyed hepatocytes, euchromatic nuclei (N)of normal hepatocytes, granular endoplasmic reticulum (ER), glycogen deposits(G), few lipid droplets(P), X6000.

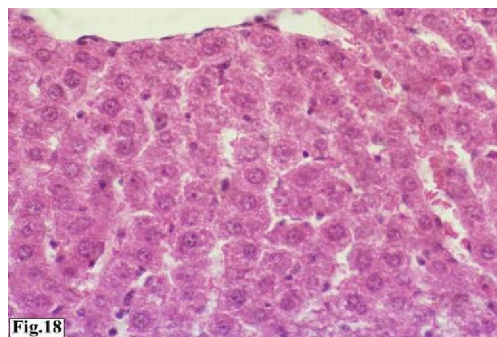


Fig.18

Fig.18: Photomicrograph for a section in the rat liver administered daily dose of enrofloxacin 10 %( 75 mg/Kg B.W.) as one dose as well as green tea extract 3% instead of drinking water for continuous 15 days, then the rats were sacrificed, displaying, most of the hepatocytes revealed normal picture with vesicular nuclei and normal nucleoli, no vascular including sinusoidal congestion, no leucocytic infiltration, H & E st.,X400

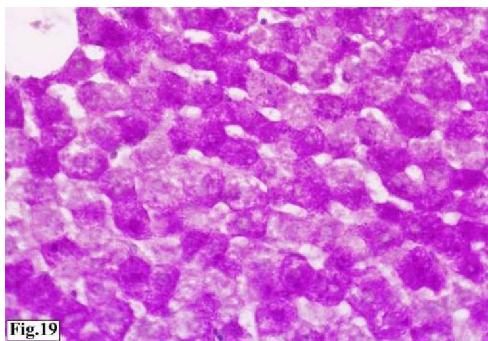


Fig.19

Fig.19: Photomicrograph for a section in the rat liver administered daily dose of enrofloxacin 10 % (75 mg/Kg B.W.) as one dose as well as green tea extract 3% instead of drinking water for continuous 15 days, then the rats were sacrificed, displaying, many of the hepatocytes deposited intracytoplasmic glycogen deposition (Magenta colour), but few ones were not, no sinusoidal congestion, no leucocytic infiltration. PAS technique, X 400.

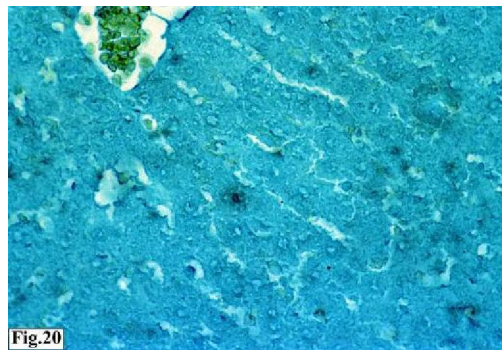


Fig.20

Fig.20: Photomicrograph for a section in the rat liver administered daily dose of enrofloxacin 10 % (75 mg/Kg B.W.) as well as green tea extract 3% instead of drinking water for continuous 15 days, then the rats were sacrificed, displaying, restored proteins in the hepatocyte cytoplasm to be more or less as the control (Fig.2). Bromophenol blue, X400

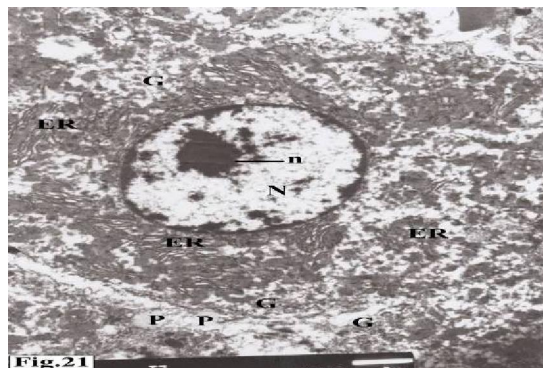


Fig.21

Fig.21: Electron micrograph for a section in the rat liver administered daily dose of enrofloxacin 10% (75 mg/Kg B.W.) as well as green tea extract 3% instead of drinking water for continuous 15 days, then the rats were sacrificed, displaying more or less intact hepatocytes with restored organelles constituents especially numerous profiles of granular endoplasmic reticulum (ER), few lysosomes (L), glycogen deposits (G), euchromatic nucleus (N) and distinct nucleolus (n) few lipid droplets in the cytoplasm of some hepatocytes as those of controls, X6000.

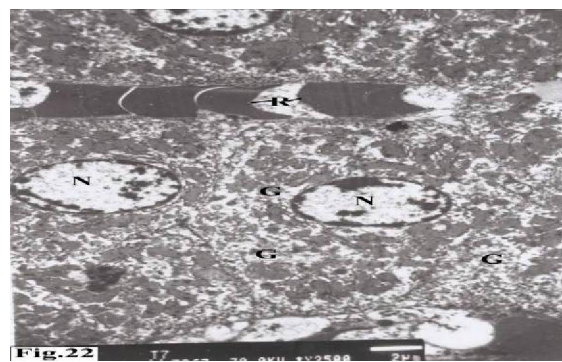


Fig.22

Fig.22: Electron micrograph for a section in the rat liver administered daily dose of enrofloxacin 10% (75 mg/Kg B.W.) as well as green tea extract 3% instead of drinking water for continuous 15 days, then the rats were sacrificed, displaying nearly normal hepatocytes after amelioration by the 3% green tea extract, tangential section of euchromatic hepatocytic nuclei (N), normal presence of red blood corpuscles (R) in non-expanded blood sinusoids, normal glycogen deposits (G), X5000.

#### 4. Discussion

Enrofloxacin is an excellent bactericidal agent against broad spectrum of aerobic and some facultative anaerobic bacteria (Elmas et al., 2001). Oxidative stress may be common factor in liver diseases of different etiologies (Parola and Robino, 2001). However, it may be thought that the major cause of EFX-induced liver toxicity is inhibition of hepatic cytochrome P450 (Vaccaro et al., 2003) that responsible for the metabolism of the drugs. Tea, one of the most accepted beverages consumed world wide by man has traditional great interest concerning its possible contribution in hindrance of many diseases as well as antioxidant properties (Mukhtar and Ahmad, 2000). Green tea found to be health benefits associated with neuroprotective, antidiabetic and antibacterial (Alscher 1998; Liao, 2001). Besides, it has markedly protective against many toxic agents as

$\text{CCl}_4$ -induces hepatotoxicity in rats (Zhen, 2007). The present study aimed at the investigation of the protective action of GTE concerning high content of EGCG, a major polyphenol in alleviating the adverse toxic effects of EFX.

A hepatotoxic dose of EFX was administered to control rat and GTE-consuming rats and the specific metabolic activities of liver were examined to ascertain potential advantage property of GTE. As shown in the results, EFX administration to rats created liver toxicity which was manifested by marked architectural disturbances of hepatic lobules as well as severe ballooning degeneration and hepatic necrosis, rising of the leucocytic infiltrations with congested blood vessels and increased collagen fibers. The increase of inflammatory cell of leucocytic infiltration might be powerful allies in body's defense against EFX-induced tissue destruction and hepatic



necrosis at which scavenger macrophages engulf dead cells as previously reported by Cotran (1999). EFX may accompanied by increase the cytosolic  $\text{Ca}^{2+}$ , by oxidative stress, by break down of phospholipid (Kumar, 2005) chief to this hepatic disturbances.

The present data agreed with work by Elasrag (2010) who found severe hepatic necrosis and DNA damage in liver kidney and spleen following administration of the identical dose of EFX, in addition to genotoxic results observed by Gorla et al. (1999). besides, histological degeneration of the testicular tissues and sperm abnormalities and morphology in male mice induced by administration of EFX (Aral et al., 2008).

After feeding with lower doses of green tea extract slight ameliorations of the unfavorable effects produced in the liver by EFX activity, which was associated with less leucocytic infiltration, glycogen enhancement in the cytoplasm, many normal intact hepatocytic nucleus and nucleolus, many normal intact mitochondria, few necrotic or destroyed hepatocytes, euchromatic nuclei of few normal hepatocytes with few lipid droplets. GT probably arrest the harmful mechanism of liver injury through protection of cells and tissues from oxidative damage by scavenging oxygen-free radicals and stimulate the regeneration of damaged tissues and cells (Jimenez-Lopez and Cederbaum, 2004; Feng et al., 2001). The result confirmed by many authors (Alschuler, 1998; Liao, 2001; Fadhell and Amran, 2002; Khan and Mukhtar, 2007), they stated that consumption of black tea and green tea has many beneficial effects on human health, particularly polyphenols, chiefly catechins and their derivatives that retard various forms of cancers due to its antimutagenic, anticarcinogenic and antioxidant properties, cardioprotective, neuroprotective, antidiabetic and antibacterial.

EFX injection caused depletion of glycogen stores in the hepatocytes indicating damaged induced in the liver tissue. It possibly due to the increased rate of anaerobic glycolysis maintaining cell energy as well as oxygen deficiency and consequently decreased many cellular enzymes activities induced by the drug (Kumar et al., 2005).

The present data of lower doses GTE consumption to EFX-treated rats result an overall improvement of carbohydrate metabolism indicating by increase of glycogen storing to the hepatocytes but in a less extent i.e. higher doses best ameliorate glycogen hepatocytes. In this respect, Waltner-law et al. (2002) explain the lowered blood glucose to the decrease in expression of genes control gluconeogenesis in liver cells while Khan et al. (2007) elucidated that GTE causes selective adaptive

alterations in the activities of certain mitochondrial enzymes involved in glycolysis, gluconeogenesis and glycogenesis in the liver cells. Also it has been shown to increase energy expenditure and fats oxidation in human (Dulloo et al., 1999; Diepvens et al., 2005).

Concerning histochemical demonstration of protein disruption after EFX treatment might be due to detachment of ribosomes from rough endoplasmic reticulum and hence reduction of protein syntheses corresponded to stress of the drug which cause damaged enzymes and free radical (Karmar et al., 2005). Moreover, EFX may cause increase in cytosol  $\text{Ca}^{2+}$  that mediates variety of deleterious effects activates a number of enzymes cell death which cause membrane damage, protein and DNA and chromatin fragmentation. In contrast to GTE consumption in combination with EFX treatment resulted reversal alteration in various protein activities in the liver tissue compared to EFX treated liver. Many hepatocytes deposited intracytoplasmic glycogen but few ones were not and the protein content of the hepatocytes nearly was restored to be more or less as those of control. The elevation of protein synthesis and hence glycogen may explain by green tea polyphenols that stimulate the transcription of phase II detoxifying enzymes mediated by an antioxidant response element (Ranjbar et al., 2005). It is probable due to the downregulation by the green tea as denoted by McCarthy et al. (2007) who found that green tea catechin suppressed the cellular DNA replication and reduces protein gene expression. In the other hand, it was previously reported that GT activities prevent damage to DNA structure (Hider et al., 2001).

Histological and histochemical disturbance occurred in liver tissue were confirmed by electron microscopic changes in liver. Hence, after EFX treatment of liver it revealed rupture of hepatocytes, haemorrhage, and scattered cytoplasmic organelles after the destruction of cell membrane. This deterioration may be regarding to the cytotoxic effects of EFX that may cause an increase in cytosolic calcium concentration owing to the net influx of  $\text{Ca}^{2+}$  across the plasma membrane and release of  $\text{Ca}^{2+}$  from mitochondria (Kumar, 2005). Or may be due to the presence of the acidic and basic functional groups of enrofloxacin giving it lipid-soluble compounds and can be penetrate tissues (Brown, 1996; Gorla et al., 1999; Abo-Elsood, 2003). Meanwhile, inhibition of catalase activity and a lipophilicity property of EFX confirm the potential bioaccumulation owing to this toxic effects was reported by Gao et al. (2008) and Migaliore et al. (2003). Our results were confirmed by previous study (Coetzee et al., 2009) that showed a significant morphological and ultrastructural

changes following treatment of enrofloxacin to *Anaplasma marginale*.

Destruction of intracellular organelles such as mitochondria, rER, lysosomes reflect the major structural and functional integrity of the intracellular assessed by the status of their respective biomarker enzymes (Khan et al., 2009).

GTE might cause lowered number of damaged mitochondria or affected macromolecules or may increased number of normally active organelles or macromolecules a marked increase in glycogen, protein, enhance lipids appears to be

Higher dose (3%)GTE showed an improvement of the cell membranes destructed by EFX and so cytoplasmic organelles was noted intact cell membranes of the hepatocytes, in this regard, Ostrowska et al.,(2004) found that enhancement in lipid peroxidation was associated with disruption of hepatocyte cell membranes, as observed through electron microscopic evaluation. So Green tea protects phospholipids from better peroxidation and prevents changes in biochemical parameters and morphologic changes. Hence, the results of this work support the suggestion that green tea protects membranes from peroxidation of lipids associated with ethanol consumption in rat liver by decreasing oxidative stress (Augustyniak, et al., 2005)

Chemopreventive intervention by different phytochemicals, particularly tea polyphenols found in green tea show 20 times more powerful antioxidant activity than vitamin C (Craig 1999). It enhances expression of intracellular endogenous antioxidants such as glutathione, glutathione peroxidase, glutathione peroxidase catalase (Khan et al., 1992; Valerio et al., 2001) reported that it reduces the generation of reactive radicals. Green tea extracts act as an antioxidant both intracellularly and extracellularly in conjunction with various enzymatic processes, multiple intracellular functions including detoxification of reactive oxygen intermediates and reduction of low-molecular weight thiols and sulfides and mixed disulfides of proteins (Ookhtens M., 1998).

In conclusion, the observation of the current study demonstrated that EFX induces production of free radical that causes oxidative scratch to the liver cells and its organelles particularly mitochondria and cell membranes. Green tea reduces this oxidative damage by its antioxidant properties and ameliorates against the drug- induced hepatotoxicity

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## **Sustainable Agriculture Extension System in Khuzestan Province, Iran (Goals, Contents, Organization and Extension agents)**

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**Abstract:** The purpose of this study was determining favorable goals and contents of sustainable agricultural extension system in Khuzestan province, Iran. Extension experts of Agricultural-Jihad organization in Khuzestan province were considered as a statistical population (N=120). All individuals were investigated. After confirm the validity of the instrument by panel of experts, to determine the reliability coefficient using Cronbach alpha coefficients were obtained for all sections of the questionnaire over 0.7 were calculated. Method of research was descriptive and correlative. Based on the results, the most important goals of extension system for supporting sustainable agriculture were: increasing knowledge and skills of sustainability, increasing productivity and efficiency, health development, technology transfer and development of food security. Also, the results that indicated the most important extension contents were: development of organic farming, development of biological control, food security contents, development of integrated management and considering crop yield. In addition, the most important characteristics that have been recommended and agricultural extension organizations must consider were: interaction communication, systematic management, occupations quality, and horizontal communication. Based on the results, the most important experts characteristics were: skills of information presentation, knowledge of adult education, knowledge of information technology, and knowledge about sustainable agriculture. Based on regression the results also showed that favorable goals, contents, organization and extension agents can explain 48% of variance of dimensions of sustainable agriculture.

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**Keywords:** Extension system, sustainable agriculture, Extension expert

### **1. Introduction**

There are widespread viewpoints about the environmental effect of agricultural practices and technologies and over the long-term sustainability of farming systems in Asia ( Garforth and Lawrence, 1997). Concern about the future generations was the main reason for changes occurred in development paradigm in the late 1980s. According to Wattenbach and Friedrich (1997), these concerns have received worldwide attention. These authors defined sustainable development as a development that meets the need of the present without compromising the ability of the future generation. Obviously, the challenges facing policymakers and producers is to increase agricultural productivity and thus ensure food security, while enhancing the productive capacity of natural resource base in a sustainable manner (Ommani, 2001).

During the past fifty years, agricultural development policies have emphasized external inputs as driving forces to increase food production. This has led to growth in global consumption of pesticides, inorganic fertilizer, tractors and other machinery (Chizari, Ommani & Noorivandi, 2006). These external inputs have substituted for natural

processes and resource, rendering them less powerful. Pesticides have replaced biological, cultural, and mechanical methods for controlling pests, weeds, and diseases; inorganic fertilizers have substituted for livestock manures, composts, and nitrogen-fixing crops.

These processes have caused conditions that resulted unsustainability in agriculture. A necessary condition for sustainable agriculture is that large number of farmer must be motivated to use, their resource in a coordinated manner. Thus, the success of sustainable agriculture depends on motivations, skills, knowledge and action taken by groups or communities as a whole (Roling and Pretty, 1997).

Agricultural extension and education is considered an essential factor in development of agricultural programs (Shahbazi, 1996). Agricultural extension and education has economic impact and sustainability in agriculture by providing information (Evenson, 1997 p. 29).

Agricultural extension is a public service for human resource development (HRD) in the agricultural sector (Van den Ban and Hawkins, 1996). Multiple studies in Iran showed that, although extension services has played a positive role in



agricultural development of Iran, but there are difficulties, barriers, misunderstandings, and weaknesses in the transfer of new technology and information to farmers (Ommani and Chizari, 2002). Lacking the suitable linkage between extension and research organizations has been a barrier for transfer of appropriate new technology to farmers (Shahbazi, 1996). Identifying favorable goals and contents of sustainable agricultural extension system in

Khouzestan province have important role to developing extension system.

Sustainable agriculture practices have tended to reduce the use of fertilizer, pesticides and maximal tillage world wide (Chizari, Ommani & Noorivandi, 2006). Sustainable resource management are related to practices which local human population use resource in sustainable manner (Chizari, Ommani & Noorivandi, 2006).

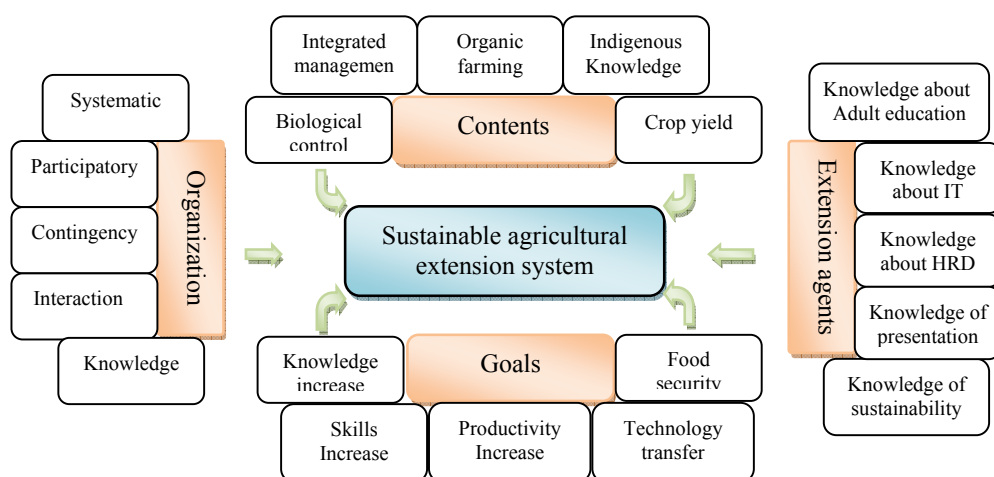


Table 1: Theoretical Framework

The success of sustainable agriculture depends on motivation, skills, and knowledge of farmers (Ommani, 2001). Extension programs have vital roles in this content. Extension can demonstrate the feasibility of sustainable practices. Consequently, sustainability is the successful management of resource to satisfy the challenging human needs, while maintaining or enhancing the quality of environment and conserving natural resource.

## 2. Material and Methods

From the viewpoint of classification of research based on objective, type of research is applied research. The research method is descriptive and correlative.

Through this method, a field study of library methods, data collection is done and the results obtained by percentage frequency, mean and variance are described. Researcher in the study investigates the correlation relationship between variables are explored. In this study Agricultural-Jihad organization in Khouzestan province as a case study organizations were selected. Extension experts in this organization, as the statistical community have been

considered that the whole community, including N=120 in the target audience as a community is considered. Return rate was 88%.

In order to validate research tools, panel of expert's method was used. Then collect the questionnaires and using the results of the opinions of experts and specialists, we have modified the questionnaire. A number of questionnaires in the next step modified using a number of contacts and complete research about the content and length of the questionnaire.

To determine the reliability of the questionnaire, 30 copies of the questionnaire in the Agricultural-Jihad organization of Tehran province has completed, then SPSS 16 software using Cronbach's coefficient alpha levels through questionnaire reliability was investigated. According to the results of questionnaire reliability levels are acceptable, and in all items over than 0.70.

## 3. Results and discussion

First, experts characteristics described and then discussed the inferential statistics are presented. This study showed that based on level of education, 85

percent of experts had B.Sc and low degree and 15 percent had M.Sc.

### Extension goals for supporting sustainable agriculture

In this research, the agricultural extension experts were questioned about the importance rate of different extension goals for supporting sustainable agriculture by 5-point scale (1=very low, 2=low, 3=moderate, 4=high, 5=very high). Extension experts believed that among extension goals, increasing knowledge and skills of sustainability (M=4.34; SD=0.91), increasing productivity and efficiency (M=4.15; SD=0.98), health development (M=4.02; SD=1.01), technology transfer (M=3.40; SD=0.99) and development of food security (M=3.89; 1.14) had very high importance for supporting sustainable agriculture. These findings are supported by Ommani and Chizari (2002). Also they claimed that for successful and sustainable introduction, use and improvement of water control techniques and technologies farmers should be encouraged to analyze their problems, search for solutions, monitor and evaluate the selected and implemented techniques and technologies, and adjust them according to their constraints and opportunities. This issue is confirmed in the researches of Sivayoganathan and Mowjood (2003), Molden (2007).

Table 1: Importance of extension goals for supporting sustainable agriculture

Extension Goals	Mean	SD*	CV**	Rank
Knowledge and skills	4.34	0.91	0.209	1
Productivity/Efficiency	4.15	0.98	0.236	2
Health development	4.02	1.01	0.251	3
Transfer of technology	3.40	0.99	0.291	4
Food security	3.89	1.14	2.93	5
Crop yield	3.75	1.12	0.298	6
Quality of life	3.48	1.05	0.312	7
Social equality	3.30	1.09	0.329	8

Scale: 1=very low, 2=low, 3=moderate, 4=high, 5=very high

\* Standard Deviation; \*\* Coefficient of Variation

### Extension contents for supporting sustainable agriculture

In this research, the agricultural extension experts were questioned about the importance rate of different extension contents for supporting sustainable agriculture by 5-point scale (1=very low, 2=low, 3=moderate, 4=high, 5=very high). Extension experts believed that among extension contents, development of organic farming (M=4.02; SD=1.08), development of biological control (M=4; SD=1.08), food security contents (M=3.51; SD=1.06), development of integrated management (M=3.42; SD=1.10) and considering crop yield (M=3.08; 0.93)

had very high importance for supporting sustainable agriculture. This finding is supported by Allahyari and Chizari (2008).

Table 2: Importance of extension contents for supporting sustainable agriculture

Extension Contents	Mean	SD*	CV**	Rank
Organic farming	4.02	1.08	0.269	1
Biological control	4.00	1.08	0.270	2
Food security	3.51	1.06	0.302	3
Integrated management	3.42	1.10	0.321	4
Crop yield	3.09	0.99	0.322	5
Farming control	3.28	1.08	0.330	6
Indigenous knowledge	2.97	0.99	0.333	7

Scale: 1=very low, 2=low, 3=moderate, 4=high, 5=very high

\* Standard Deviation; \*\* Coefficient of Variation

### Extension organization characteristics for supporting sustainable agriculture

Extension experts believed that among extension organization characteristics, interaction communication (M=3.69; SD=1.04), systematic management (M=4; SD=1.08), occupations quality (M=3.51; SD=1.06), and horizontal communication (M=3.49; 0.97) had very high importance for supporting sustainable agriculture. This finding is supported by Allahyari and Chizari (2008).

Table 3: Importance of extension organization characteristics for supporting sustainable agriculture

Extension Organization	Mean	SD*	CV**	Rank
Interaction communication	3.69	1.04	0.258	1
Systematic management	4.00	1.08	0.265	2
Occupations quality	3.51	1.06	0.270	3
Horizontal communication	3.49	0.97	0.277	4
HRD	4.00	1.11	0.284	5
Local groups	4.00	1.12	0.286	6
Participatory management	3.41	1.03	0.302	7
Hierarchy	2.97	0.99	0.333	8
Contingency management	2.68	0.98	0.366	9

Scale: 1=very low, 2=low, 3=moderate, 4=high, 5=very high

\* Standard Deviation; \*\* Coefficient of Variation

### Extension agent's characteristics for supporting sustainable agriculture

Extension experts believed that among extension agents characteristics, skills of information presentation (M=3.31; SD=0.89), knowledge of adult education (M=3.20; SD=0.90), knowledge of information technology (M=3.21; SD=0.90), and knowledge about sustainable agriculture (M=3.20; 0.90) had very high importance for supporting sustainable agriculture.

### Regression Analysis

According to the regression coefficients and the constant value obtained from multiple regression

analysis stepwise method, regression equation under investigation form was obtained:

$$Y = 18.237 + 0.434X_1 + 0.133X_2 + 0.329X_3 + 0.346X_4$$

Table 4: Importance of extension agents characteristics for supporting sustainable agriculture

Extension agents	Mean	SD*	CV**	Rank
<b>Knowledge about:</b>				
Information presentation	3.31	0.89	0.269	1
Adult education	3.20	0.90	0.280	2
Information technology	3.21	0.90	0.281	3
Sustainable agriculture	3.20	0.90	0.282	4
HRD	3.10	0.89	0.287	5
Participatory approaches	3.10	0.90	0.289	6
Facilitator	3.00	0.89	0.298	7
Farm management	3.00	0.91	0.303	8

Scale: 1=very low, 2=low, 3=moderate, 4=high, 5=very high

\* Standard Deviation; \*\* Coefficient of Variation

Table 5. Results of multiple regression analysis step by step style

Independent variables	B	SE B	Beta	t	sig
Goals	0.434	0.123	0.262	2.334	0.020
Contents	0.133	0.197	0.237	2.321	0.027
Organization	0.329	0.143	0.243	2.643	0.010
Extension agents	0.346	0.293	0.302	1.09	0.031
Constant	18.237	4.636	----	2.317	0.001

R<sup>2</sup>=0.481, Signif F=0.010 F= 4.635

The results also showed that favorable goals, contents, organization and extension agents can explain 48% of variance of dimensions of sustainable agriculture (Table 5).

#### 4. Recommendations

The results of this study were identified important extension system goals that are essential for supporting sustainable agriculture. Agricultural extension organizations in provincial and national levels can benefit from these proposed goals firstly in program development for farmers and secondly in professional development in the future. The most important goals of extension system for supporting sustainable agriculture were: increasing knowledge and skills of sustainability, increasing productivity and efficiency, health development, technology transfer and development of food security.

Also, the results of this study were identified important contents of extension system that are essential for supporting sustainable agriculture. Agricultural extension organizations in provincial and national levels can benefit from these proposed contents. The results that indicated the most important extension contents were: development of organic farming, development of biological control, food security contents, development of integrated management and considering crop yield.

In addition, the results would guide the extension policy makers in the province and country to be aware of the important extension organization characteristics which are necessary for supporting sustainable agriculture. The most important characteristics that have been recommended and agricultural extension organizations must consider were: interaction communication, systematic management, occupations quality, and horizontal communication.

Based on the results, the extension organizations of Khuzestan province are encouraged to consider most important characteristics of extension agents for program execution. The most important characteristics were: skills of information presentation, knowledge of adult education, knowledge of information technology, and knowledge about sustainable agriculture.

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## Educational Needs of Watershed Experts (WEs) of Khuzestan Province, Iran Regarding of Sustainable Water Resources Management (SWRM) in Agriculture

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**Abstract:** The purpose of this research was determining educational needs and perceptions of Watershed Experts (WEs) regarding sustainable water resources management (SWRM) in agriculture. The research method was descriptive research. Total population of experts in the study included all (watershed experts N=79) of Agricultural-Jihad Organization of Khuzestan Province, Iran. The return rate questionnaires was 92.4% (N=73). Based on the results approximately, 75.4% of respondents had moderate perceptions about SWRM in agriculture. Ranking based on coefficient of variation indicated that the six most important training needs of watershed experts were: (1) New irrigation systems, (2) Identifying appropriate cultivation models, (3) Integrated insect pest management, (4) Water productivity and efficiency in agriculture, (5) Recycling farm waste, and (6) Crop rotations. In-service training programs play a critical role in reinforcing staff capability, as well as renewing their skills. The organizations and institutes which are responsible for in-service training both for agricultural experts must consider training needs of them.

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**Keywords:** Watershed Experts, Sustainable water management, Khuzestan.

### 1. Introduction

Iran is located in the Northern Hemisphere between 25 and 40 N and 44 to 63 E. Agriculture plays an important role in the economy of Iran. It accounts for more than 80% of food requirements (Keshavarz et al., 2003).

Keshavarz et al (2003) pointed out, that overall irrigation efficiency in Iran ranges from 33 to 37%, which is lower than the average for developing countries (45%) and developed countries (60%). Apparently, the Iranian farmers consumed a lot more water per hectare than what is done globally for different crops (Hasheminia, 2004). Water is a vital resource for human health, economic development and environmental quality (Ommani and Noorivandi, 2003). Also water is an essential component in agriculture. Current conventional practices promote soil erosion, sedimentation, salinization and loss of natural wetland and watershed systems. In order to exam the role of agricultural water resources management in sustainable agriculture, economics, social equity and environment should be considered as important elements (Chizari, et al., 2006). FAO (2003) in a report about the Iranian economy and the role agricultural sector play in economy states: increase of agricultural activities due to use of chemical materials has contributed to the pollution of water. Also FAO reported that irrigation efficiency in the Middle East region is low. Based of this report,

Iran ranked second after Iraq by 32%. Also, FAO iterated that water loss in Iran is very high. Iran in this regard is ranked second after Pakistan by 45 billion m<sup>3</sup>.

By using participatory approaches to identify agricultural production constraints and educational need assessment in irrigated agriculture unfold the way for improved productivity (FAO, 2001). The major consumer of water in Iran is the agriculture sector. Improving the water resources management in agriculture has been one of the major objectives of Economical Development Programs of Iran (Najafi, 2006).

Sustainable water resources management (SWRM) describes the set of approaches particular to transmittal, consumption and conservation of water resource in agriculture (Ommani, 2010). It is consists of multiple approaches that include (Keshavarz, et al., 2003; Alizadeh and Keshavarz, 1998; FAO, 2001):

- Special attention to the integrated use of water and other agricultural inputs (e.g. fertilizers, pesticides, etc.) and their impact on environment.
- Use of pressurized irrigation systems for optimized water consumption.
- Optimization of Irrigation efficiency and water productivity of agricultural lands in farm scale.
- Improvement on surface irrigation in farms.
- Reduction of evaporation losses from soil surface in irrigated farms.



- Modifications on current cropping patterns for the optimum use of water resource for agricultural production and to increase agricultural productivity.
- Notice to nutrient soil management to increase maintenance ability of water.
- Building channel cement in path of water to transmit to farms.
- Manufacturing water maintenance pool for increase velocity water entry to farms.
- Allocating water resource to high economic value plants.

The goal of sustainable agroecological systems is to understand how natural ecosystems work and how communities, tribes or governments can use this knowledge to their advantage instead of working against it.

In Iran, many researches have done about water management in the agro-business sector. They have looked at the problems and suggested possible solutions to improve the situation. Most of these researchers have tried to integrate certain facets of water management in the agricultural field (e.g. Keshavarz, et al., 2003; Sepaskhah and Fooladmand, 2003; Tavakoli and Ahmadnejad, 2003; Arasteh, et al., 2003; Ommani and Noorivandi, 2003; Khatoonabadi, 2003; Najafi, 2006; Aghaee et al, 2003; Chizari, et al., 2006; Chizari, et al., 2006). Based on the above consideration, one of the major objectives of environmental, social and economical programs of Iran has been to identify ways such as extension mechanisms for supporting of sustainable water resources management in agriculture. One of the major aims of the Ministry of Agricultural-Jihad (MAJ) of Iran has been to increase the efficiency of water use through extension of new technology of irrigation systems and to development the models to predict the adoption behavior of farmers regarding new technology of irrigation (Karami, et al., 2006).

Province of Khuzestan is located in the southwest of the country, bordering Iraq and the Persian Gulf. Its capital is Ahwaz and it covers an area of 63,238 km<sup>2</sup>. Khuzestan is the most ancient Iranian province and is often referred to in Iran as the "birthplace of the nation" (Ommani, 2001). The variety of agricultural products such as wheat, barley, oily seeds, rice, eucalyptus, medical herbs; the existence of many palm and citrus farms; having mountains suitable for raising olives, and of course sugar cane - from which Khuzestan takes its name - all show the great potential of this fertile plain (Chizari, et al., 2006). In recent years, Khuzestan Province encountered with shortage of water resource. Water resources management in agriculture and increasing the water use efficiency in Khuzestan province have vital role for conservation of water resource (Organization of Agricultural-Jihad of

Khuzestan, 2004). The purpose of this research was determining educational needs and perceptions of Watershed Experts (WEs) regarding sustainable water resources management in agriculture.

## 2. Material and Methods

The research method was descriptive research. In descriptive research, the researcher describe variables and may look for relationships among them, but does not manipulate the variables (Gay and Airasian, 2003). This method seeks to determine relationships among two or more variables. Total population of experts in the study included all watershed experts (N=79) of Agricultural-Jihad Organization of Khuzestan Province. The return rate was 92.4% (N=73).

A questionnaire was developed for gathering information from experts. The model questionnaires derived from studies of Arellanes and Lee (2003); Hersman (2004); Boone et al (2007); Keshavarz, et al., (2003); Rezaei-Moghadam, et al., (2005); Chen, (2005). The questionnaire of experts covered three areas:

- *Part One: Perceptions of experts regarding Sustainable Water Resources Management (SWRM) in agriculture.*

We examined perceptions of experts regarding Sustainable Water Resources Management (SWRM) in agriculture by 12 items. Likert scale (1=strongly disagree, 2=disagree, 3=unsure, 4=agree, 5= strongly agree) was used in this regard.

- *Part Two: Training needs of experts regarding SWRM in agriculture*

Also, we examined training needs of experts by 12 items. These items were regarding transmittal, consumption and conservation of water resources.

- *Part three: Determining demographic characteristics of experts.*

This part determined characteristics of experts such as; age, level of education, position, and location of work.

## 3. Results and discussion

### Watershed Experts' Demographic Profile

The first section described watershed experts' demographic profile in Khuzestan Province of Iran. Approximately, 56.2% of respondents were between 20 to 30 years of age and 35.6% of them between 31 to 40 years of age (Table 1). Most respondents (83.6%) reported work experience, including 1 to 10 years and the vast majority of them were male (89.04%).

In reference to the frequency of respondents' contact with research centers and other experts, 43.8% of watershed experts in total claimed that they have often direct contact with extension experts that are

working regarding sustainable practices. About 91.8 % of experts had a bachelor degree level (Table 1).

Table 1. Agricultural extension experts' demographic profile

Variables	Fre	Per	Cum Per
Age (years)			
20 to 30	41	56.2	56.2
31 to 40	26	35.6	91.8
41 to 50	6	8.2	100
Total	73	100	
Level of Education			
Bachelor of Science	66	90.4	90.4
Master of Science	6	8.2	98.2
Doctorate	1	1.4	100
Total	73	100	
Gender			
Male	65	89	89
Female	8	11	100
Total	73	100	
Work Experience (years)			
5 or less	13	17.8	17.8
6 to 10	19	26	43.8
11 to 15	26	35.6	79.4
16 to 20	11	15.1	94.5
21 or more	4	5.5	100
Total	73	100	
Contact with			
Research centers	14	19.2	19.2
University faculty members	6	8.2	27.4
Other agricultural extension experts that are working regarding sustainable practices.	32	43.8	71.2
Other experts that are working regarding sustainable practices.	7	9.6	80.8
Research centers and other agricultural extension experts	7	9.6	90.4
Without	7	9.6	100

Table 3. Perceptions of watershed experts about items of SWRM in agriculture

Do experts have a clear perceptions about SWRM in agriculture?													
When I hear the term sustainable water resource management in agriculture .....	Strongly Disagree		Disagree		Unsure		Agree		Strongly Agree		Mean	Sd	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%			
1. Profitability readily comes to mind.	----	----	----	----	----	----	46	63	27	37	4.369	0.486	
2. Productivity readily comes to mind.	----	----	----	----	----	----	47	64.4	26	35.6	4.356	0.482	
3. I do consider it a priority for present clientele interactions.	----	----	----	----	7	9.6	34	46.6	32	43.8	4.342	0.650	
4. Organic farming readily comes to mind.	----	----	----	----	7	9.6	28	38.4	26	35.6	3.589	0.879	
5. I do consider it a priority for future clientele interactions.	----	----	8	11	6	8.2	20	27.4	39	53.4	4.260	0.972	
6. Low chemical input readily comes to mind.	----	----	----	----	9	12.3	14	19.2	50	68.5	4.616	0.658	
7. Environmental protection readily comes to mind.	----	----	----	----	20	27.4	14	19.2	39	53.4	4.260	0.866	
8. Conservational technologies readily come to mind.	----	----	----	----	----	----	15	20.5	58	79.5	4.808	0.396	
9. I do consider it environmentally sound.	----	----	7	9.6	----	----	19	26	47	64.4	4.452	0.913	
10. I do consider it as proof that is economically feasible.	----	----	7	9.6	7	9.6	40	54.8	19	26	3.972	0.865	
11. I do consider it as proof that is socially acceptable.	----	----	----	----	6	8.2	13	17.8	54	74	4.643	0.653	
12. New irrigation method readily comes to mind.	----	----	----	----	1	1.4	45	61.6	27	37	4.360	0.488	

Scale: 1=strongly disagree, 2=disagree, 3=unsure, 4=agree, 5= strongly agree

Total 73 100

### General Perceptions of Watershed Experts Regarding SWRM in Agriculture

Asked watershed experts to give their perceptions about items of SWRM in agriculture on a five Likert scale (1=strongly disagree, 2=disagree, 3=unsure, 4=agree, 5= strongly agree). Their answers to these items in combination led to the perceptions of watershed experts about SWRM in agriculture. Based on interval of standard deviation from the mean perceptions of watershed experts about SWRM in agriculture divided to five levels. Approximately, 75.4% of respondents had moderate perceptions about SWRM in agriculture (Table 2).

Table 3 presents the perceptions of watershed experts about items of SWRM in agriculture. Table 4 shows that approximately 63% of watershed experts agreed that when they were asked term sustainable water resources management in agriculture profitability readily comes to mind.

Table 2. Perceptions levels of watershed experts about SWRM in agriculture

Perceptions levels	f	%	Cum %
Very low	7	9.6	9.6
Low	5	6.8	16.4
Moderate	55	75.4	91.8
Very high	3	4.1	95.8
High	3	4.1	100
Total	89	100	

Scale: 1=strongly disagree, 2=disagree, 3=unsure, 4=agree, 5= strongly agree

Mean: 47.67 Median: 50 SD: 5.85

Table 4. Training needs of watershed experts regarding SWRM in agriculture

What areas of sustainable water resources management do watershed experts desire training?																
I need to training on the following topics....	Without		Very Low		Low		Average		High		Very High		Mean	SD*	CV* *	Rank
	f	%	f	%	f	%	f	%	f	%	f	%				
1. Integrated insect pest management.	---	---	---	---	---	---	7	9.6	41	56.2	25	34.2	4.246	0.618	0.145	3
2. Organic matter management.	---	---	---	---	---	---	21	28.8	33	45.2	19	26	3.972	0.744	0.187	10
3. Water quality with respect to agrichemicals.	1	1.4	2	2.7	3	4.1	8	11	13	17.8	46	63	4.438	0.795	0.180	9
4. Crop rotations.	---	---	---	---	---	---	14	19.2	33	45.2	26	35.6	4.164	0.726	0.174	6
5. Food safety and pesticide residues.	2	2.7	3	4.1	2	2.7	7	9.6	27	37	32	43.8	4.246	0.759	0.178	8
6. Recycling farm waste.	---	---	---	---	1	1.3	13	17.8	40	54.8	19	26	4.068	0.673	0.165	5
7. Economics of sustainable agriculture.	---	---	2	2.7	---	---	10	13.7	28	38.4	33	45.2	4.274	0.750	0.175	7
8. Communication in sustainable agriculture.	---	---	---	---	---	---	21	28.8	26	35.6	26	35.6	4.068	0.805	0.198	12
9. Water productivity and efficiency in agriculture	---	---	1	1.4	2	2.7	4	5.5	34	46.6	32	43.8	4.342	0.650	0.145	4
10. Identifying appropriate cultivation models.	---	---	---	---	---	---	---	---	26	35.6	47	64.4	3.972	0.482	0.121	2
11. Biological systems.	---	---	---	---	7	9.6	7	9.6	33	45.2	26	35.6	4.643	0.917	0.197	11
12. New irrigation systems.	---	---	---	---	---	---	---	---	20	27.4	53	72.6	4.726	0.449	0.095	1

### Training Needs of Watershed Experts Regarding SWRM in Agriculture

To address training needs of watershed experts 12 items were asked from them. The results are displayed in table 5. The scale used range from 0 to 5 (0=without, 1=Very low, 2= Low, 3= Average, 4= High, 5= Very High). In reference to the frequency of respondents about training needs, 72.6% of respondents stated that they had high need to education regarding new irrigation systems and 27.4% mentioned that they had very high need to training regarding new irrigation systems.

Ranking based on coefficient of variation indicated that the six most important training needs of watershed experts were: (1) New irrigation systems (M= 4.726, Sd= 0.449), (2) Identifying appropriate cultivation models (M= 3.972, Sd= 0.482), (3) Integrated insect pest management (M= 4.246, Sd= 0.618), (4) Water productivity and efficiency in agriculture (M= 4.342, Sd= 0.650), (5) Recycling farm waste (M= 4.068, Sd= 0.673), and (6) Crop rotations (M= 4.167, Sd= 0.726). (Table 4).

### Discussion and Recommendations

Based on the results perceptions of watershed experts about SWRM in agriculture divided to five levels. Approximately, 75.4% of respondents had moderate perceptions about SWRM in agriculture. This issue is confirmed in the researches of Chizari, et al., (2006). According to experts watershed attitude regarding SWRM and identifying their training needs, is essential for training needs to be action. Also background necessary to promote this technology over the past be provided in rural areas. Providing conditions that promote watershed managers and agriculture experts to interact with each other in designing training programs and promotional efforts

on sustainable management of water drawn. Development of knowledge and operational insights and professional empowerment of farmers and provide infrastructure facilities for field optimize utilization of water resources will have to follow.

In-service training programs play a critical role in reinforcing staff capability, as well as renewing their skills. The organizations and institutes which are responsible for in-service training both for agricultural experts must consider training needs of them. Ranking based on mean and standard deviation by using coefficient of variation indicated that the six most important training needs of watershed experts were: (1) New irrigation systems, (2) Identifying appropriate cultivation models, (3) Integrated insect pest management, (4) Water productivity and efficiency in agriculture, (5) Recycling farm waste , and (6) Crop rotations. This result is confirmed in the research of Chizari, (2006).

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## Infrastructure Resource Planning in Modern Power System

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**Abstract:** Generation Expansion Planning (GEP) is one of the most important issues in long-term power system planning. In from past, investigators noticed to GEP and supply of energy. In power system planning, generation expansion planning is performed for 5-years planning horizon or more. There are two main objective functions in GEP. First is the minimization of investment cost and another one is the maximization of reliability. GEP use future likeable engineering economics function, in order to drive certain indicator. Supply of fuel problem is one of the most important of effective factors for result. For this reason, Some times GEP and fuel supply center go hand-in-hand. In this case, construction and operation cost of transmission network add to power system costs. This paper presents the simultaneous generation expansion planning with Natural Gas Expansion Planning (NGEP), as the fuel for generation units

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**Keywords:** Combines Cycle Generation Technology (CCGT), Generation Expansion Planning (GEP), Load Dispatch Planning, Natural Gas Expansion Planning (NGEP)

### 1. Introduction

Energy, Environment, Economy (EEE) is among of basic challenges in electricity industry for the 21<sup>st</sup> century. Supplying of energy with the minimum levels of possible environment contaminations, costs and the maximum levels of reliability, is an important problem in the industrialized societies. Generation companies (GENCo) has tendency to utilize more efficiency, economy, secure units with the minimum level of pollutant gasses by electricity industry restructuring, privatization and separation between Generation, Transmission, Distribution parts and to have more competition in these parts. In Power system, GEP include determining capacity that is required for long-term planning horizon, technologies of generation units and construction time interval and location for each unit. GEP problem in restructured and modern power system toward conventional systems is very complex. Generation technologies are classified into two categories:

- Conventional energy (Coal, Oil, Gas, Nuclear, and Hydro)
- Unconventional and Renewable ones (Solar, Wind, Fuel cells, Biomass, Geothermal, Micro gas-turbines, etc).

One of the methods for improving the efficiency is augmenting these units. In large units, Combines Cycle Generation Technology (CCGT) can decrease the costs. The supply of fuel source for combined cycle units is very important. Because of more and greater efficiency, less pollution and low

level of equipment depreciation, competitive electricity market has tendency to utilize natural gas (Shahidepour et al., 2005).

One of the most important characteristics of natural gas is their problem of reserving in comparison with other resources of fossil fuel and due to it identity to consume in consumption places and extraction points or special centers connected to gas supplying network which is very high (Hatice et al., 2009).

Based on TDCA's report, within the Middle East, Iran has the most gas resources and has the second rank in the worldwide ranking after Russia. However, producing of natural gas in Iran compared with resources is very less and has got fourth place of worldwide producing after Russia, US and Canada. This producing is only three percent of worldwide gas production.

Thus, natural gas can be one of the foresight potentials in future infrastructure expansion of Iran's energy. Demand for natural gas is expected to become more in coming decades, because of rapid growth of electrical energy generation units based-on natural gas (For example combined cycle units as one model of centralized generation units, or micro gas-turbine as one model of Distributed Generation (DG) units).

### 2. Generation Expansion Planning

Power network consists of equipments and apparatus, which is responsible for Generation, Transmission and secures Distribution of electrical energy for consumers need. There is a need to exact



and detailed studies, in order to more expansion and optimized utilization of power networks (Gallego et al., 2000).

Generally, Studies about power system planning can divided into two categories:

- Network Expansion Planning
- Operation Planning

Network Expansion Planning is a long-term planning (Usually for 5-years horizon or more). Operation planning is divided into three parts (EPRI EL-2561, 1982):

1. Fuel allocation and maintenance scheduling (for one year or more)
2. Unit commitment (Day-Ahead or Weekly-Ahead)
3. Load Dispatch Planning (from a few minutes to one hour)

In operation planning, the supposition is that equipment in the network have sufficient adequacy. In this planning, the purpose is the providing secure and economy electrical energy for consumer needs by employing the equipments in the network (Jaeseok et al., 2006). If the network has not maintained the demanded adequacy of providing the energy for consumer, Network Expansion Planning (NEP) is necessary for long-term (Khatib, 2003). The main objective of these investigations is the confirming network adequacy by adding new equipment to the network. In other words, in network expansion planning's studies, purposes are determining the type of new equipments, features of equipments and time and the place of equipments installation, so that costs of preparation and installation equipments must be at minimum cost while providing optimal network adequacy. The lack of adequacy of powerhouses in providing of power needed, the lack of quality of transmission network in generating power transmission and power station insufficiency of network in load supplying can lead into lack of adequacy of network in providing electrical energy. In other words determining features of powerhouses and the appropriate time to build new powerhouses and to have new transmission lines and so new power stations, in order to ideal providing energy of consumers needed, are the typically purpose of the network expansion planning's problem.

Problem solving in NEP for a large network is more complex. Hence, because of an optimal solution, the problem must divide into sub-problems. In general, NEP's studies divided into three sub-problems, as:

- Generation Expansion Planning (GEP)
- Transmission Expansion Planning (TEP)
- Substation Expansion Planning (SEP)

It is obvious that whatever the problem divided into smaller sub-problems, solving the

problem is easier. Nevertheless, the solution is not an absolute optimal solution. For this reason, in some studies, for obtaining the best and suitable solutions, simultaneous planning of GEP and TEP or simultaneous planning of TEP and SEP, has been studied (Taherkhani, 2009).

From past to now, many studies with different approaches is presented about solving of GEP's problem. Commonly, one multi-objective problem of GEP with different approaches such as minimizing investment cost, environmental issues, reliability, fuel and transmission loss allocation, security and recently investment in generation network expansion by using DG units is presented in (Jaeseok et al., 2006).

In this paper, coordination of main infrastructures for supplying of thermal energy is considered. For example, about hydroelectric units, the necessary and sufficient condition is coordination between these units and Down-Stream (DS) units, Up-Stream (US) units and Pumped-Storage (PS) ones.

In the case of decision on construction of a hydroelectric unit, studies of electrical energy generation are not the first priority and in importance ranking, it indicated after supplying of drinking and agriculture water and flood control in some cases. Nevertheless, existing of enough water resources is necessary for dam construction. About construction and coordination of pumped-storage units, conditions are different and somewhat similar to the scenario that considered in this article.

Actually, initial infrastructure (water resources for down-stream dam) should be available and accessible to construction of pumped-storage powerhouse. Whatever, the penstock of water transmission will be longer from dam to reservoir; operation and construction will be more expensive. In this case, objective function of problem is minimizing total costs. Technical constraints should be considered this goal.

The construction problem of new thermal powerhouse is very similar to the problem mentioned above and the major difference is that, because of special conditions of problem, should be coordination between natural gas expansion planning and GEP. In this case, the conditions are not established similar to above problem and expansion of each of those cannot independent of another. Therefore, coordination between GEP and NGEPP will be performed for long-term planning horizon.

Generally, GEP's problem can express as costs of system:

- Operation costs
- Investment costs

Which operation costs are consist of constant operation costs and variable ones, which indicate the fuel cost, crew payment, maintenance costs and etc. In addition, investment costs include costs of construction for new power plants.

Minimize OF = ( costs of investment + costs of operation)

The following are some constraints and restrictions of GEP:

- Capacity constraints
- Reliability constraints
- Generating pollutions limitations
- Restriction on amount of special-fuel usage
- Restriction on generating energy of a set of power plants
- Budget Restriction
- Restriction on capacity of capital

### 3. Coordination of GEP and NGEP

The coordination between GEP and Natural Gas Expansion Planning (NGEP) is very important in interconnected power systems. It is necessary that, the coordination of two electrical system and natural gas network formulate together. The purpose of this planning is to minimize investment and operation costs of both systems simultaneously that are common with each other in some parts of problem (Clodomiro, et al., 2007).

Final optimization can be express as:

$$\text{Min} \quad \sum_{t=1}^T \frac{1}{(1+\alpha)^{t-1}} [EGEP + OCEE + NGEP + OCNG] \quad (1)$$

Where

$\alpha$  : Annual discount rate  
 EGEP : GEP Investment (constant value)  
 OCEE : Operation Cost of GEP (variable value)  
 NGEP : Investment of NGEP (constant value of)  
 OCNG : Operation Cost of Natural Gas network (variable value)

The formulation of first term of the objective function is written as;

$$EGEP = \sum_{i=1}^I \sum_{j=1}^J ICE\_Hy_{i,j}^t * ST\_Hy_{i,j}^t + \sum_{i=1}^I \sum_{j=1}^J ICE\_Th_{i,j}^t * ST\_Th_{i,j}^t + \sum_{m=1}^M \sum_{n=1}^N ICE\_InE_{m,n}^t * ST\_InE_{m,n}^t \quad (2)$$

Where

$i$  : Main Bus Indices

$j$  : The number of option of exciting technology for every generation technology

$ICE\_Hy_{i,j}^t$  : The capital needed for construction of the  $j$  type of hydroelectric unit at Bus  $i$ .

Similarity  $ICE\_Th_{i,j}^t$  is written for construction of thermal units and  $ICE\_InE_{m,n}^t$  is written for construction of tie line between two points of power system.

$ST\_Hy_{i,j}^t$  is hydroelectric unit status that it is a binary variable. If the hydroelectric unit is installed and the possibility of utilization is provided in year  $t$ , this value is 1, otherwise  $ST\_Hy_{i,j}^t$  is 0.

In similar way,  $ST\_Th_{i,j}^t$  and  $ST\_InE_{m,n}^t$  have been proposed, for thermal units and tie-lines, respectively. In addition,  $n$  and  $m$  imply to load centers that are connected to each other by tie-lines.

The formulation of second term of objective function is written as;

$$OCEE = \sum_{i=1}^I \sum_{j=1}^J \gamma_{i,j}^t * Th_{i,j}^t + \sum_{i=1}^I \delta_i^t * EED_i^t \quad (3)$$

Where

$\gamma_{i,j}^t * Th_{i,j}^t$  : Production costs of energy for thermal unit with technology  $j$  at Bus  $i$ , which  $\gamma_{i,j}^t$  is the cost of generation unit and  $Th_{i,j}^t$  is the quantity of energy generated by exciting thermal unit in power system.

$\delta_i^t * EED_i^t$  : Shadow price that is imposed on power system at Bus  $i$  (energy can be supplied and without any investment in GEP) which  $\delta_i^t$  is the shadow price of generation unit at Bus  $i$ .

$EED_i^t$  : The amount of energy not supplied

The formulation of third term of objective function that presents the investment in gas network is written as;

$$NGEP = \sum_{i=1}^I \sum_{j=1}^J ICG_{i,j} \cdot Ex_{i,j}^t \cdot ST_{i,j} + \sum_{m=1}^M \sum_{n=1}^N ICG_{m,n} \cdot InG_{m,n}^t \cdot ST_{m,n} \quad (4)$$

Where

$ICG_{i,j} \cdot Ex_{i,j}^t$  : The cost of investment needed for exploration and installation of natural gas extraction equipments by technology  $j$  at Bus  $i$ .

$ICG_{m,n} \cdot InG_{m,n}^t$  : Amount capital needed for gas transmission by gas pipelines and accessory equipments between two nodes of gas network.

Similar to previous term, two binary variables are indicated for each mentioned variables that are defined as;

$$ST_{i,j} \cdot Ex_{i,j}^t \text{ and } ST_{m,n} \cdot InG_{m,n}^t$$

Moreover, the formulation of last term of objective function that presents the operation costs of gas network is written as;

$$OCNG = \sum_{i=1}^I \sum_{j=1}^J \vartheta_{i,j}^t \cdot NG_{i,j}^t + \sum_{i=1}^I \beta_i^t \cdot NGD_i^t \quad (5)$$

Where

$\vartheta_{i,j}^t$  : Cost of natural gas extraction.

$NG_{i,j}^t$  : Cost of natural gas extraction. (The lack of gas supply in consumption center can add a penalty factor, in the same way in electrical energy).

$\beta_i^t$  : Penalty factor (this amount can be different for each point and in every year).

$NGD_i^t$  : Amount of natural gas, which not supplied.

The constraints related to the units, that we studied, are defined as;

$$\sum_{t=1}^T ST_{i,j} \cdot Hy_{i,j}^t \leq 1 \quad ; i = 1, \dots, I; \forall j \in i \quad (6)$$

$$\sum_{t=1}^T ST_{i,j} \cdot Th_{i,j}^t \leq 1 \quad ; i = 1, \dots, I; \forall j \in i \quad (7)$$

$$\sum_{t=1}^T ST_{i,j} \cdot Ex_{i,j}^t \leq 1 \quad ; i = 1, \dots, I; \forall j \in i \quad (8)$$

For electrical transmission lines construction:

$$\sum_{t=1}^T ST_{m,n} \cdot InE_{m,n}^t \leq 1 \quad ; m = 1, \dots, M; n = 1, \dots, N \quad (9)$$

For natural gas pipelines:

$$\sum_{t=1}^T ST_{m,n} \cdot InG_{m,n}^t \leq 1 \quad ; m = 1, \dots, M; n = 1, \dots, N \quad (10)$$

As mentioned above, the variables in constraints (6) to (10) are binary variables, as:

$$ST_{i,j} \cdot Hy_{i,j}^t; ST_{i,j} \cdot Th_{i,j}^t; ST_{m,n} \cdot InE_{m,n}^t;$$

$$ST_{i,j} \cdot Ex_{i,j}^t; ST_{m,n} \cdot InG_{m,n}^t \in \{0,1\}$$

These variables represent the applying and the time of applying of equipments needed to power system. Investment costs and constant costs must be considered once a planning. In addition, (1) is included the results of the inflation and amount of interest.

Qualify and adequacy of power system in GEP is expressed as:

$$\sum_{j=1}^J Hy_{i,j}^t + \sum_{j=1}^J Th_{i,j}^t + EED_i^t \geq \Theta_i^t EL_i^t \quad (11)$$

$$; i = 1, \dots, I; t = 1, \dots, T$$

Equation (11), presents the relation between the sum of energy that generate by hydroelectric units ( $Hy_{i,j}^t$ ) and thermal units ( $Th_{i,j}^t$ ), and amount of load. It should be note that Load Duration Curve (LDC),  $\Theta_i^t$  defines the amount of load at each Bus and time  $t$ .

If the expected energy not supplied in a part of power system, the mentioned part will be shutdown in that time period. In this case,  $EED_i^t$  represents this issue.

There is a similar situation for supplying and adequacy of natural gas resources. Formulation (12) shows this issue, as:

$$\sum_{j=1}^J NG_{i,j}^t - \sum_{j=1}^J \psi_{i,j}^t \cdot Th_{i,j}^t \geq \Phi_i^t NGL_i^t \quad (12)$$

$$; i = 1, \dots, I; t = 1, \dots, T$$

Where

$NG_{i,j}^t$  is amount of natural gas generation in each extraction sites.

Total amount of extracted natural gas from gas wells must be greater than amount of demand at each time at load centers.

$\psi_{i,j}^t$  is considered in the case of focused technology conversion of thermal units to other forms of technology, and using natural gas as fuel or fuel substitution of natural gas for other forms (gas oil or fuel oil).

As mentioned earlier, operation of power system should be added to GEP's problem, whether

for existing units or in the case of added units in planning horizon.

These costs for generation units are consisting costs of equipments maintenance, crew costs, installment payment, costs of fuel and for gas natural network, and these costs are consisting costs of maintenance of equipments, pumping costs, costs of pressure increase/reduction devices and stations and pipelines operation and maintenance costs.

$$CT\_XX_{YY}^r = \begin{cases} 1 & \text{for } t \geq r \\ 0 & \text{for } t < r \end{cases} \quad (13)$$

$r = \text{The Time of Installing Apparatus } XX$

Where

$r$  is the year which equipment is installed.

For existing equipments that are in service, formulation above is written as:

$$CT\_XX_{YY}^r = 1$$

But, for new equipment, the criterion is the time of the equipments installation in power system and utilizing of them.

In the case of electrical energy, because of limitation on supplying of water resources, the amount of hydroelectric energy generation will be limited. Because of specified amount of water withdrawal during each period, lower bound is defined in an annual planning, as:

$$CT\_Hy_{i,j}^r * \Theta_i^t * H_{i,j}^{\min} \leq Hy_{i,j}^t \leq CT\_Hy_{i,j}^r * \Theta_i^t * H_{i,j}^{\max} \quad (14)$$

It should be note that, the reason of water withdrawal is the supplying of drinking water and Down-Stream dams, also to prevent water overflow (on dam).

LDC is used to determining the upper and lower bound of amount of energy generation by hydroelectric units.

Similarly, this modeling can be expressed for thermal units, as:

$$CT\_Th_{i,j}^r * \Theta_i^t * T_{i,j}^{\min} \leq Th_{i,j}^t \leq CT\_Th_{i,j}^r * \Theta_i^t * T_{i,j}^{\max} \quad (15)$$

If there is a transmission line, the limitations are consider on upper and lower bounds for amount of transmitted power between node  $n$  and node  $m$ .

$$CT\_InE_{m,n}^r * \Theta_i^t * InE_{m,n}^{\min} \leq InE_{m,n}^t \leq CT\_InE_{m,n}^r * \Theta_i^t * InE_{m,n}^{\max} \quad (16)$$

Note that in lossless power system:

$$InE_{m,n}^t = InE_{n,m}^t$$

Amount of load that is not supplied has a minimum level in each generation units. This amount can be determined by reliability standards. According to the diagnosis, security parameters, technical parameters and economic parameters, etc and amount of load that may be not supplied are recognizable in each point of power system, defined as:

$$0 \leq EED_i^t \leq EED_i^{\max} \quad (17)$$

There are some limitations on gas extraction from gas wells, limitation from the standpoint of pressure, limitation in gas well equipments and natural gas storage, and restriction on gas share with other countries. These restrictions and limitations can be moderated the amount of extracted natural gas in each period.

$$CT\_Ex_{i,j}^r * \Phi_i^t * NG_{i,j}^{\min} \leq Ex_{i,j}^t \leq CT\_Ex_{i,j}^r * \Phi_i^t * NG_{i,j}^{\max} \quad (18)$$

In addition, there are some limitations for extracted natural gas transmission by gas pipelines.

Formulation (19) represents this issue.

$$CT\_InG_{m,n}^r * \Phi_i^t * InG_{m,n}^{\min} \leq InG_{m,n}^t \leq CT\_InG_{m,n}^r * \Phi_i^t * InG_{m,n}^{\max} \quad (19)$$

In a similar way, amount of natural gas that not supplied at any time period and at each point of system, are determined by a series of economic and technical studies. Obviously, each system tends to minimize amount of load that be not supplied.

$$0 \leq NGD_i^t \leq NGD_i^{\max} \quad (21)$$

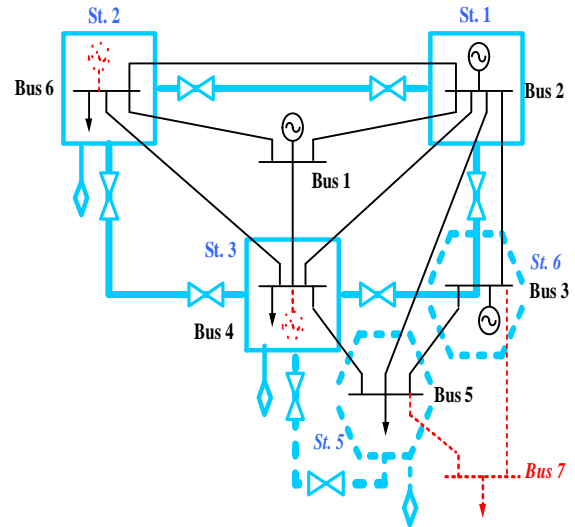
The amount of electrical energy that generated by hydroelectric units and thermal units, should be in allowed limitation. In these conditions, constraints (22) to (32) show that available generation units must supply the amount of load and reserve for each hour. Note that these values must be economic.

$$\sum_{m=1}^T ST\_Hy_{i,j}^m * \Theta_i^t * H_{i,j}^{\min} \leq Hy_{i,j}^t \leq \sum_{m=1}^T ST\_Hy_{i,j}^m * \Theta_i^t * H_{i,j}^{\max} \quad (22)$$

## 4. Simulation

In this simulation, GEP is considered for 10-years planning horizon. Annual load growth and interest rate are estimated of %10 and %15 for each year, respectively. Three types of technologies are suggested for generation units, that depending on the time required for their construction, 3, 5 and 6 years is needed. Capacity of these units are 100 MW, 150 MW and 250 MW, respectively and the generation cost for each units are estimated at 75, 73 and 70 \$/MWh respectively and installation costs are estimated at 1, 1.3 and 2 million dollars for each units, respectively. In this paper, heat rate for natural gas is 13.8 MBTU/MWh and minimum thermal value of natural gas is 26.8 m<sup>3</sup>/MBTU that by conversion to Mm<sup>3</sup>/MMWh (Million Cubic Meters/Million MWh) this value will be attained 0.00370 Mm<sup>3</sup>/MMWh (or 370 m<sup>3</sup>/MWh). The generation cost of electrical energy for unit with capacity of 100 MW will be 66.6 \$/MWh. If one suppose that the cost of transmission is 304 \$/MWh, the net income is going to 70 \$/MWh. With considering the other costs such as, maintenance costs, depreciation costs and crew costs, the final cost is estimated at 75\$/MWh. Actually, in this paper revenue of units for per MWh charge will be 8.4 \$/MWh (75-66.6 = 8.4). Note, the congestion rent and expense can go to minimum value by management in operation. Final costs are 73 \$/MWh and 70 \$/MWh for units with a capacity of 150 MW and 250 MW, respectively. Obviously, using of a larger unit causes investment costs will be more and operation costs will be less (Shishebori et al., 2010).

- A unit with capacity of 100 MW has been purposed at Bus 3, simultaneous with construction of pressure reduction station 6 in third-year.
- In fifth-year, a unit with capacity of 150 MW will be constructed at Bus 6 that its fuel can be provided from station 2.



- Economic deliberation and three transmission lines represent that the best option for expansion is the construction and utilization of a unit with capacity of 250 MW at Bus 4. Via considering equal times for construction of units with capacity of 150 MW and 250 MW (5 years), this option will be the best and expansion plan will limit at Bus 6. However, because of the costs of load that not supplied (in fifth-year) and other econometrics parameters, a unit with capacity of 150 MW must construct and utilize in network, inevitably. Fig.1 shows the generation expansion planning and gas network at Bus 6.

Because of load growth at Bus7, (build an industrial factory) it is necessary to construct an electrical meshed network through Bus3 and Bus5 at seventh-year and eighth-year, respectively (because of shout down costs of industrial load).

If the new industrial zone is intended to construct a DG unit or diesel generator, this zone can make a decision to natural gas expansion planning at next years or buy gas oil, install and utilize diesel generator. In addition, this new zone will need to construction cost of a pressure reduction station and gas pipelines and feasibility study of electrical energy with network and obtaining revenue in peak load and intermediate load conditions.



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## Effect of Different Concentrations of Benzalkonium Chloride on the Cornea

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**Abstract:** Aim of the work: The overall objective of this study is to evaluate the effect of benzalkonium chloride (BAK) on the conformational characteristics of the cornea. Materials and methods: New Zealand white rabbits were used in this study for application of different concentration of BAK (0.005%, 0.01% and 0.02%) for different periods (4, 8, 12 and 16 days). Results: The study reports the corneal structure alterations that may be induced as a result of BAK applications that were studied by Fourier transform infrared spectroscopy (FTIR). The resulting IR spectra were analyzed using the band enhancement procedure. The obtained data clearly indicate that there are different structural and conformational changes as the method of BAK applications.

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**Key words:** Benzalkonium chloride, Eye, Cornea, FTIR, Rabbits.

### 1. Introduction:

The most common preservative in topical ophthalmic preparations is benzalkonium chloride (BAK). This is a quaternary ammonium compound composed of a mixture of alkylbenzyltrimethylammonium chloride homologues with  $n\text{-C}_{12}\text{H}_{25}$ ,  $n\text{-C}_{14}\text{H}_{29}$  and  $n\text{-C}_{16}\text{H}_{33}$  comprising a major portion of the alkyl groups present (United States Pharmacopeia–National Formulary [USP–NF] 2005)<sup>(1)</sup>. It is commonly used at concentrations of 0.004–0.025%. Several investigations using animal models have suggested the existence of links between BAK and cytotoxic effects on several components of the eye.

Using a rabbit model, Furrer et al. (2001)<sup>(2)</sup> demonstrated that 28 days of treatment with beta-blockers preserved in BAK 0.01% or benzododecinium bromide 0.012% resulted in microlesions covering nearly 9% of the corneal surface. Administration of solutions containing 0.01% BAK has been linked to the infiltration of immunocompetent cells into the limbus and bulbar conjunctiva in rats<sup>(3)</sup>. The inflammatory reaction was associated with severe damage to the cornea and conjunctiva, including epithelial alterations and keratinization. Several other animal studies have shown that preservatives are linked to the onset of chronic fibrosis in the conjunctiva<sup>(4,5)</sup>. Noecker et al. (2004)<sup>(6)</sup> investigated the extent of epithelial and corneal damage associated with Purite® (Allergan, Inc, Irvine, California, USA), a stabilized oxychloro complex, and with topical antiglaucoma medications preserved with BAK. In addition to damaging the cornea and conjunctiva, preservatives may also cause severe lesions in the retina. In pigmented rabbits, subconjunctival injection of timolol (0.5%) or befunolol (1%) preserved with BAK caused retinal lesions, retinal detachment, loss of visual acuity and

atrophy of the pigmented epithelium of the retina and choroids<sup>(7)</sup>. Jaenen et al. (2007)<sup>(8)</sup> showed that signs of damage to the conjunctiva, cornea and eyelids significantly decreased when patients were switched from preserved to preservative-free medication, or even when the number of eye drops containing BAK was decreased. This effect demonstrated the dose-dependency of BAK-induced manifestations. Masahiko and Atsuo (2010)<sup>(9)</sup> evaluated the cytotoxicity of prostaglandin analog eye drops preserved with BAK in multiple corneoconjunctival cell lines and they concluded that various dilutions and exposure times provided a unique evaluation of cytotoxicity among ophthalmic solutions. Zhirong et al. (2011)<sup>(10)</sup> found that topical administration of 0.2% BAK in mouse induces changes resembling that of dry eye syndrome in humans.

In the present work, the effect of different concentrations of BAK; 0.005%, 0.01% and 0.02% for 4, 8, 12 and 16 days on the conformational characteristics of the cornea was evaluated by Fourier transform infrared spectroscopy.

### 2. Materials and methods

Rats (*Rattus Norvegicus*) were randomly selected from the animal house facility at the Research Institute of Ophthalmology, Giza, Egypt. The research protocol was approved by the local ethical committee that applies the ARVO (the Association for Research in Vision and Ophthalmology) statements for using animals in ophthalmic and vision research. Benzalkonium chloride was obtained from Acros organics (NJ, USA) then was dissolved in de-ionized water in order to prepare the three concentrations 0.005, 0.01 and 0.02 % (w/v) that will be applied to the animal's eyes. These BAK solutions were freshly prepared each day. The rats were randomly classified

into control (n=10, 20 eye balls) and three BAK-treated groups (each composed of 40 rats/4 subgroups) that received topical instillation of 10 $\mu$ L twice a day of 0.005, 0.01 or 0.02% BAK. The animals of each BAK-treated subgroup (n=10) were monitored at 4, 8, 12 and 16 days (D). Corneas were obtained from rats via cutting through the ora serrata. The corneas from all animals subgroup were weighed separately, and then crushed to powder by the aid of liquid nitrogen and mortar. The resulted corneal powder was freeze-dried for 24 h then mixed with potassium bromide (KBr) powder (95 mg KBr:5 mg cornea) in order to prepare the KBr disks that will be used for the FTIR measurement. FTIR spectra were recorded using Shimadzu FTIR spectrometer, where the instrument was operated under continuous flow of dry nitrogen gas to minimize the effect of water vapor and atmospheric CO<sub>2</sub>. Hundred interferograms were recorded for each sample to enhance the signal to noise ratio, these interferograms were co-added, baseline corrected and smoothed by Savitzky-Golay before Fourier transform. The spectra that belong to each BAK-treated subgroup were averaged using OriginPro7.5 software to obtain the final average subgroup spectrum. This final average subgroup spectrum was subjected to the curve enhancement procedure; a combination of Fourier deconvolution and non-linear curve fitting, to resolve the contour of NH group (3900-3000 cm<sup>-1</sup>), CH group (3000-2800 cm<sup>-1</sup>) and the finger print region (1400-1000 cm<sup>-1</sup>) to its underlying peaks. The number of the resulted underlying peaks was confirmed by the second derivative of the subgroup spectrum.

### Statistical analysis

Data were expressed as the mean $\pm$ SD. Comparison between multiple groups was performed using analysis of variance (ANOVA), commercially available statistical software package (SPSS-11, for windows) was used where the significance level was set at p<0.05. All the spectral analysis was performed with OriginPro 7.5 software (Origin Lab Corporation, Northampton, MA, USA).

### 3. Results

Figure (1) shows the infrared frequency range 3900-3000 cm<sup>-1</sup> that corresponds to the stretching of NH-OH groups. The curve enhancement procedure; a combination of Fourier deconvolution and non-linear curve fitting, revealed the mean peak of the normal pattern into two components centered at 3598 $\pm$ 3 cm<sup>-1</sup> and 3492 $\pm$ 2 cm<sup>-1</sup> due to OH stretching (strOH), a peak centered at 3319 $\pm$ 2 cm<sup>-1</sup> due to NH asymmetric (NH<sub>asym</sub>) and CH ring centered at 3073 $\pm$ 3 cm<sup>-1</sup>. As shown in table 1, due to treatment with BAK strOH was splitted into three components in 0.01 % treated group regardless the follow up period. On the other hand,

treatment with the lowest BAK concentration was associated by fluctuated changes in the number of estimated components as well as in their band position and band width. The last observation regarding this band can be seen in the highest BAK treated group, where the number of the estimated bands was mimicking the control ones but for 8-D group. In addition, the two modes of vibrations; OH<sub>asym</sub> and OH<sub>sym</sub>, was detected (appeared) in the BAK treated groups in a manner that do not directly relate to the applied periods and the concentration as well. In the same context, the NH<sub>sym</sub> mode of vibrations was also detected (appeared), as compared to the normal, in many of the BAK treated groups; this mode is sensitive to the highest concentration; 0.02 %. Meanwhile, the NH<sub>asym</sub> mode of vibration was also found to be sensitive to the BAK treatment; it was restricted at 8-D group (0.05%), 4-D and 16-D groups (0.01%) and 8-D and 12-D groups treated with 0.02%. Finally, for the CH<sub>ring</sub> mode of vibration, there were two common observations; there was no change in the band frequency that was associated with significantly increased band width.

The CH stretching region (3000-2800 cm<sup>-1</sup>) shown in fig (2) indicates the presence of four bands in the control samples centered at 2962  $\pm$ 3, 2926 $\pm$ 3, 2874 $\pm$ 4 and 2854 $\pm$ 3 cm<sup>-1</sup> that can be assigned to <sub>asym</sub>CH<sub>3</sub>, <sub>asym</sub>CH<sub>2</sub>, <sub>sym</sub>CH<sub>3</sub> and <sub>sym</sub>CH<sub>2</sub> stretching vibration, respectively. In the data of the CH stretching region given in table (2), the <sub>asym</sub>CH<sub>3</sub> vibrational mode was transitionally affected after treatment with 0.02% BAK solution for 12 days where its band position and bandwidth were significantly increased; meanwhile they remained unchanged to the rest of BAK treated groups. On the other hand, the <sub>asym</sub>CH<sub>2</sub> mode of vibration shows different characteristics where its bandwidth was reduced as a result of BAK treatment with different concentrations, while its band frequency was unaffected and remained in the range of the control one. The characteristics (band position and bandwidth) of the symmetric modes of vibration (CH<sub>3</sub> and CH<sub>2</sub>) were also unchanged in all BAK treated groups for all the followed periods involved in the study.

The third region of the FTIR shown in fig.3 is the finger print region (1500-900 cm<sup>-1</sup>). The normal sample indicates the presence of eight bands: (1) CH<sub>2</sub> bending at 1457 $\pm$ 3 cm<sup>-1</sup>, (2) COO<sub>sym</sub> at 1398 $\pm$ 2, (3) CH<sub>3</sub> bending at range 1335 $\pm$ 2 to 1284 $\pm$ 3 cm<sup>-1</sup>, (4) <sub>asym</sub>PO<sub>2</sub> at 1238 $\pm$ 2 cm<sup>-1</sup>, (5) CH deformation at 1200 $\pm$ 3 cm<sup>-1</sup>, (6) COOC<sub>asym</sub> at 1167 $\pm$ 2 cm<sup>-1</sup>, (7) NH<sub>3</sub> rocking at 1127 $\pm$ 1 cm<sup>-1</sup> and (8) <sub>sym</sub>PO<sub>2</sub> at 1069 $\pm$ 3 cm<sup>-1</sup> (11). As a result of the application of BAK some observations can be concluded from Table (3):

**CH<sub>2</sub> bending:** No change in band position. The bandwidth decreased in all groups but 0.02 %, 4-D group.

**COO<sub>sym</sub>:** No change in band position and bandwidth after application of BAK

**CH<sub>3</sub> bending:**

- No change in the frequency of the lower frequency component ( 1280 cm<sup>-1</sup>)
- No change in frequency of the higher frequency component ( 1335cm<sup>-1</sup>)
- At 0.01 % concentration applied for 8-D, only one component was detected with different frequency (1323 cm<sup>-1</sup>) relative to the control ones
- The band detected at 1312 cm<sup>-1</sup> disappeared in 8-D group (0.005 %).
- The lowest frequency component ( 1280 cm<sup>-1</sup>) was absent in the following groups 4-D (0.01%), 4-D and 12-D (0.02%).
- The bandwidth was reduced for the detected higher frequency ( 1335 cm<sup>-1</sup>). Meanwhile, the bandwidth of the detected lower frequency component fluctuated without any trend that can be related to application of BAK.

**asymPO<sub>2</sub>:** Although this band was restricted at 4-D group as a result of 0.005% BAK treatment, there were no changes in its band position or bandwidth from the other different BAK concentration treatment.

**CH deformation:** The band detected in different BAK treatment groups was characterized by unchanged band position associated with increased bandwidth in two groups only; 4-D (0.005) and 4-D (0.01%). The most interesting observation is the absence of this mode of vibration at the longer period (16-D) of different BAK concentrations used in this study.

**COOC<sub>asym</sub>:** As a result of application of BAK with concentration of 0.005% for 4 days and 8 days; this mode of vibration was restricted. With the increase in the applied period as well as by increasing the BAK concentration, this mode was detected with lower frequency as compared with the control one. This was concomitant with variation in its bandwidth that cannot be related to application of BAK.

**NH<sub>3</sub>rocking:** The vibrational frequency of NH<sub>3</sub> rocking increased for the 4-days group with the lowest concentration of BAK (0.005%) then decreased for all other studied groups. The band width showed the same phenomena.

**symPO<sub>2</sub>:** There is an increase in the vibrational frequency for all studied groups compared to the normal. Also there is a splitting of the peak for the 8-days group (0.01 %). Also fluctuations of the band width were observed.

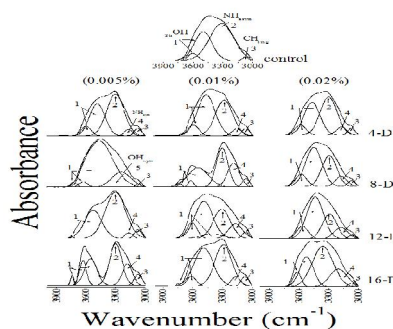


Figure 1: Representative FTIR spectra of the normal and BAK treatment groups in the NH-OH region and the estimated component.

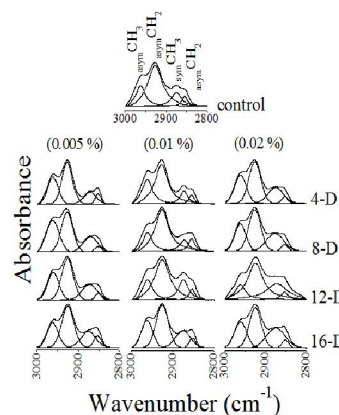


Figure 2: FTIR spectra for the wavenumber ranging from 3000 to 2800 cm<sup>-1</sup> of the normal corneas and BAK treatment groups.

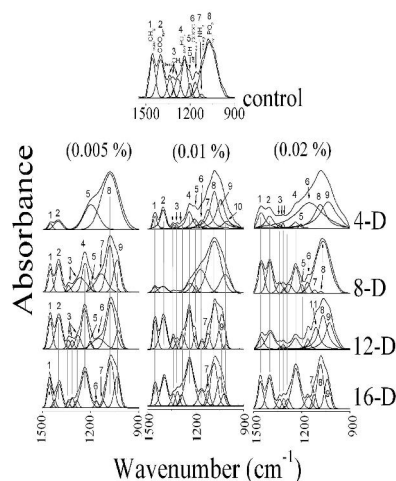


Figure 3 : Fingerprint region ranging from 1500-900 cm<sup>-1</sup> of the normal corneas and BAK treatment groups; showing the corresponding estimated components.

Table 1. Band assignment, wavenumber ( $\text{cm}^{-1}$ ), bandwidth ( $\text{cm}^{-1}$ ) and estimated components of corneal tissue in the NH-OH region for normal and all groups receive benzalkonium chloride treatment

		StrOH		OH <sub>asym</sub>	NH <sub>asym</sub>	OH <sub>sym</sub>	NH <sub>sym</sub>	CH <sub>ring</sub>
0.005%	Control	3598±3	3492±2		3319±2			3073±3
		92±5	156±8		254±6			51±3
	4-D	3600±3	3490±3		†3303±2		3172±2	3071±4
		93±5	154±8		†173±8		75±1	†64±4
	8-D	3684±2	3627±2	3476±2		3244±2		3070±3
0.01%		195±12	85±6	287±10		52±1		†187±2
	12-D	3740±3	3526±2		†3303±3		3168±3	3076±3
		27±4	171±3		†201±10		71±1	†66±4
	16-D	3743±3	3631±3	3553±21124±7	†3300±3		3182±3	3073±3
		28±4	68±4		†122±9		99±1	†73±3
0.02%	4-D	3601±3	3471±3			†3291±2	3162±3	3075±4
		115±4	177±4			†174±1	89±1	†66±3
	8-D	3733±4	3624±3	3552±3	†3310±3		3196±3	3073±4
		37±5	47±4	205±5	†114±7		118±2	†63±3
	12-D	3740±4	3611±3	3491±31178±6	†3310±3		3173±4	3072±3
		216±9	99±6		†166±7		136±2	†61±4
	16-D	3738±4	3614±3	3491±3190±5		†3292±4		3075±4
		20±3	86±7			†167±2		†67±4
	4-D	3586±2	3469±1		†3302±3		3172±2	3073±3
		114±2	158±9		†168±6		98±2	†63±4
	8-D	3576±2				†3290±3	3175±3	3071±2
		115±4				†144±2	107±1	†66±5
	12-D	3565±3	3437±2			†3290±2	3180±2	3070±3
		117±3	162±8			†138±1	129±2	†63±4
	16-D	3621±2	3526±2		†3362±2		3203±3	3070±3
		76±6	137±8		†209±9		173±2	†59±2

† Statistically significant; The second line represent the bandwidth± SD.

Table 2. Frequency values and bandwidth ( $\text{cm}^{-1}$ ) of the CH stretching region of normal and all groups received BAK.

		asymCH <sub>3</sub>	asymCH <sub>2</sub>	SymCH <sub>3</sub>	SymCH <sub>2</sub>
0.005%	Control	2962±3	2926±3	2874±4	2854±3
		26±6	47±3	29±6	16±5
	4-D	2962±3	2926±2	2872±2	2852±3
		27±5	†26±5	32±4	13±2
	8-D	2963±3	2927±2	2870±2	2852±3
0.01%		31±5	†28±4	36±2	16±3
	12-D	2962±4	2926±4	2873±3	2852±3
		28±4	†29±2	34±3	15±4
	16-D	2962±3	2925±3	2875±3	2853±3
		28±4	†30±2	35±4	18±5
0.02%	4-D	2962±3	2928±2	2873±2	2855±3
		28±3	†36±1	22±6	16±3
	8-D	2961±3	2926±4	2872±2	2854±4
		25±5	†37±2	24±2	16±2
	12-D	2962±3	2927±339±2	2857±4	2854±2
		27±3		27±3	15±4
	16-D	2962±3	2926±4	2875±3	2852±3
		27±1	†30±2	36±4	14±3
	4-D	2963±4	2926±4	2876±3	2853±3
		30±5	†30±2	39±6	15±1
	8-D	2962±3	2927±3	2877±3	2853±2
		†28±3	†30±2	40±6	15±1
	12-D	†2873±4	2853±3	2975±2	2859±4
		†61±2	†18±1	39±7	20±6
	16-D	2960±3	2925±2	2875±4	2850±3
		30±4	†29±2	40±7	15±2

† Statistically significant;

The first line in each cell reflects the band position, while second line reflects the band width



Table 3. General band assignment of the fingerprint region for normal and all groups received Benzalkonium chloride.

	CH <sub>2</sub> bending	COO <sub>sym</sub>	CH <sub>3</sub> bending	asym PO <sub>2</sub>	CH deformation	COOC <sub>asym</sub>	NH <sub>3</sub> rocking	sym PO <sub>2</sub>	COC	CH bending
<b>Control</b>	1457±3 (45±4)	1398±2 (45±3)	1335±2 (40±3) 1312±3 (15±6) 1284±3 (37±6)	1238±2 (43±7)	1200±3 (24±7)	1167±2 (26±6)	1127±1 (62±5)	1069±3 (98±5)		
<b>4-D</b>	1456±2 (25±6)	1403±3 (50±4)			1200±2 (91±8)			1077±1 (110±9)		
<b>8-D</b>	1454±2 (25±3)	1400±1 (38±6)	1338±2 (20±4) <sup>†</sup> 1268±5 (77±8) <sup>†</sup>	1235±2 (35±4)	1199±3 (21±6)		1136±2 (69±4)	1081±1 (44±8)	1035±2 (43±1)	
<b>12-D</b>	1455±2 (26±5)	1399±3 (42±4)	1339±3 (17±2) <sup>†</sup> 1316±2 (22±1) 1281±3 (33±4)	1237±2 (36±3)	1202±3 (17±5)	1153±2 (80±2)		1076±1 (52±7)	1028±2 (34±1)	
<b>16-D</b>	1457±1 (24±4) 1425±2 (17±5)	1395±2 (38±5)	1338±2 (12±5) <sup>†</sup> 1314±4 (20±1) 1286±2 (20±6) <sup>†</sup>	1236±1 (49±5)		1163±1 (17±1)	1120±2 (16±6)	1079±2 (43±6)	1035±2 (37±1)	
<b>4-D</b>	1454±2 (23±2)	1402±2 (36±7)	1338±2 (8±3) <sup>†</sup> 1317±3 (14±2)	1239±2 (44±3)	1204±3 (43±8)	1160±1 (46±3)	1120±1 (50±3)	1082±2 (57±4)	1042±2 (60±4)	1001±6 (58±5)
<b>8-D</b>	1455±3 (26±7)	1403±3 (47±2)	1323±3 (53±3)	1234±4 (50±6)	1201±2 (16±5)	1160±2 (73±4)		1081±2 (80±6)		1013±4 (62±2)
<b>12-D</b>	1454±1 (26±2)	1400±2 (41±2)	1338±2 (18±4) <sup>†</sup> 1316±2 (19±2) 1282±3 (29±6) <sup>†</sup>	1239±2 (36±6)	1202±1 (17±5)	1160±1 (21±1)	1120±1 (25±3)	1079±2 (41±5)	1035±1 (36±2)	1008±2 (15±3)
<b>16-D</b>	1454±2 (24±6)	1396±1 (43±1)	1338±2 (22±3) <sup>†</sup> 1313±2 (21±1) 1287±3 (23±5) <sup>†</sup>	1237±1 (54±7)		1160±1 (40±3)	1120±2 (23±4)	1084±4 (40±4)	1047±5 (37±1)	1021±5 (28±5)
<b>4-D</b>	1456±1 (56±8)	1400±1 (50±4)	1339±3 (22±5) <sup>†</sup> 1316±3 (12±1)	1238±2 (43±4)	1203±1 (21±4)	1151±2 (198±3)		1083±1 (83±2)	1033±1 (117±2)	
<b>8-D</b>	1454±1 (35±3)	1398±1 (39±5)	1336±3 (31±3) <sup>†</sup> 1312±2 (13±3) 1280±4 (40±5)	1237±2 (37±4)	1201±1 (23±3)	1164±1 (26±1)	1120±1 (19±6)	1081±1 (14±3) <sup>†</sup> 1067±1 (95±1)		
<b>12-D</b>	1454±1 (33±4)	1397±2 (56±9)	1337±4 (16±4) <sup>†</sup> 1316±3 (25±1)	1239±2 (48±4)	1207±4 (15±4)	1162±1 (25±3)		1076±1 (59±4)	1027±2 (60±4)	
<b>16-D</b>	1457±1 (30±5)	1400±3 (42±3)	1338±2 (26±3) <sup>†</sup> 1311±3 (20±2) 1285±2 (24±3) <sup>†</sup>	1236±1 (53±8)		1158±1 (36±4)	1122±1 (22±7)	1084±1 (40±6)	1040±2 (39±1)	

<sup>†</sup>Statistically significant, the numbers between brackets represent the bandwidth ±SD

#### 4. Discussion

Ophthalmic solutions are formulated to achieve long shelf-life, effective antimicrobial action, comfort to the patient, penetration and action of the active agent(s), and minimal side effects. Tissue reactions from these preparations are often tolerated to gain one or more specific benefits. However, there are frequent situations when specific drug components may induce serious iatrogenic diseases, possibly vitiating any beneficial effects on the primary disease process. The cationic surfactant benzalkonium chloride is a common disinfectant in topical ophthalmic formulations<sup>(12)</sup> and its side effect on the cornea has been frequently

investigated<sup>(13,14,15,16,17,18)</sup>. So in the present work the effect of different concentrations of BAK; 0.005%, 0.01% and 0.02% for 4, 8, 12 and 16 days on the conformational characteristics of the cornea was evaluated by FTIR.

The NH-OH region (table, 1) was very sensitive to the BAK treatment whether the concentration was 0.05% (lowest concentration) or 0.02 % (the highest concentration). These bands are found in membrane constituents as the lipid, protein and the genetic material as well. Thus BAK treatment induces functional changes in the membrane constituents that may be related to the previously documented biohazard

effects of BAK when used as an ophthalmic preservative. Several studies<sup>(19,20,21)</sup> found that benzalkonium chloride can denature corneal protein and cause irreversible damage to the eye.

The CH vibrational region (table, 2) is used generally to characterize the lipid molecules. The band width of the asym CH<sub>2</sub> vibrational frequency was decreased after application of BAK also asym CH<sub>3</sub> vibrational frequency was affected indicating an environmental change. The cooperative effect between the changes in the NH-OH region and the CH vibrational region may also be seen in the fingerprint region. The PO<sub>2</sub> stretching modes are characterized by some changes in their environment. This may reflect interaction/binding mechanism(s). The CH<sub>2</sub> bending is of special interest, because it can be used to monitor the tissue disorder. As shown in table (3), there is no change in the vibrational frequency but the bandwidth was decreased after application of BAK. Also the changes in the vibrational frequency and the bandwidth of COOC<sub>asym</sub> or NH<sub>3</sub> rocking confirm the changes in the environment.

The greatest biocidal activity is associated with the BAK. The mechanism of bactericidal/ microbicidal action is thought to be due to disruption of intermolecular interactions. This can cause dissociation of cellular membrane lipid bilayers, which compromises cellular permeability controls and induces leakage of cellular contents<sup>(22,23,24,25)</sup>.

### 5. Conclusion:

From this study, FTIR spectroscopy is a technique, which provides quantitative biochemical information about biological samples. BAK induces structural and conformational changes of the cornea. Also the extensive use of BAK in ophthalmic preparations must be critically reviewed and its use, if indicated, curtailed. The studies of the induced changes effects of BAK should be done to the different ocular structure.

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4/2/2011

## Calibration of UVA Radiometers

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**Abstract:** A general methodology of the calibration of broad band ultraviolet (UVA) radiometers is considered and categorized in this paper, based on the concepts of comparison method of effective irradiance responsivity. Also an example of calibration set-up and uncertainty budget presented.

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Key words: Radiometry, Radiometer calibration, UVA radiometer.

### 1. Introduction:

Naturally the irradiance level of UVA changes due to region and time where it is measured. Also lamp aging affects the level of irradiance from artificial source at the same measuring condition.

Low cost and ease of use, ultraviolet (UVA) radiometers (some times called UVA meters) are widely used for measuring UVA radiation in various industrial, medical, environmental, health and other applications.

UVA radiometers usually comprise of a detector head, a signal converter and a display unit. The detector head consists of a photo-detector, a spectral filter, a beam-limiting aperture and a diffuser. The spectral filter is used to shape the spectral response of the detector head to match a spectrum of the application. For example, to study the effect of solar radiation on human skin, the spectral response of the UV meter should match the action spectrum of the erythral function. For UVA measurement, the required spectral response is a square function from 315nm to 400nm. Therefore, a UV meter is usually designed to measure the effective irradiance generated by a source defined as the irradiance spectrally weighted by the action spectrum of the phenomenon of concern.

Previous work provide the theoretical basis for the calibration of broadband UV meters

$$E_c = \int_0^{\infty} E_{\lambda,c} s(\lambda)_{act} d\lambda \quad (1)$$

Where,  $E_{\lambda,c}$  is the spectral irradiance produced by a source  $c$  at the position of measurement.

And  $s(\lambda)_{act}$  is the action spectrum with peak value of unity.

The calibration of a UV irradiance meter is the ratio of its output and the actual value of the effective

irradiance produced by the calibration source at the meter head:

$$R_c = \frac{i}{E_c} = \frac{i}{\int_0^{\infty} E_{\lambda,c} s(\lambda)_{act} d\lambda} \quad (2)$$

Or

$$R_c = \frac{i}{E_c} = \frac{A s_0 \int_0^{\infty} S_{\lambda,c} s(\lambda)_{rel} d\lambda}{\int_0^{\infty} S_{\lambda,c} s(\lambda)_{act} d\lambda} \quad (3)$$

Where  $i$ ,  $A$  are the output and receiving area of the meter head,

$s(\lambda)_{rel}$  is the relative spectral responsivity, normalized to its peak value  $s_0$ .

and,  $S_{\lambda,c}$  is the spectral radiant power of the source received by the detector. The detector head should be overfilled by the radiation flux. [1,2].

### 2. Terminology

- A radiometer is a device for measuring the power of electromagnetic radiation.
- Ultraviolet (UV) light is electromagnetic radiation with a wavelength shorter than that of visible light, but longer than x-rays, in the range 10 nm to 400 nm, and energies from 3eV to 124 eV.
- UVA sub-range of ultraviolet range defined by ISO 21348 as the longer ultraviolet range of (315 nm <  $\lambda$  < 400) nm.[3]
- UVB sub-range of ultraviolet range defined by ISO 21348 as the medium ultraviolet range of (280 nm <  $\lambda$  < 315) nm. [3].
- UVC sub-range of ultraviolet range defined by ISO 21348 as the short wave, or

germicidal ultraviolet range of (100  $\lambda < 280$ ) nm. [3].

- UVA Radiometer is a device for measuring the irradiance of electromagnetic radiation in the range 315nm-400nm., in ( $\text{W/m}^2$ ) and its multiplications.

### 3. Scope

This method is carried out for calibration of UVA radiometers with spectral responsivity range 315- 400 nm peaked at 365nm.

### 4. Description of the type of item to be tested or calibrated

The procedure directed to calibrate the radiometers that measure the UVA irradiation in  $\text{Watt/meter}^2$  and its multiplications. These devices mainly are consider as one unit (sensor and read out unit). Also these devices can be with digital or analog outputs.

### 5. Parameters or quantities and ranges to be determined

This method of measurements use multiplications of the irradiance unit  $\mu\text{W/cm}^2$  at the range  $200 \mu\text{W/cm}^2 - 6000 \mu\text{W/cm}^2$ .

### 6. Apparatus and equipment, including technical performance requirements

The set up of this calibration include the following apparatus:

- 1- UV light source.
- 2- Reference Radiometer, calibrated at the range of UVA radiation.
- 3- UVA filter.
- 4- Variable diaphragm.
- 5- Computerized linear translation stage if available, can be substitute by linear manual stage.
- 6- Alignment laser.
- 7- Light enclosure.
- 8- Optical bench if available can be substituted by flat rugged table.
- 9- Optical accessories (bases, holders, etc).

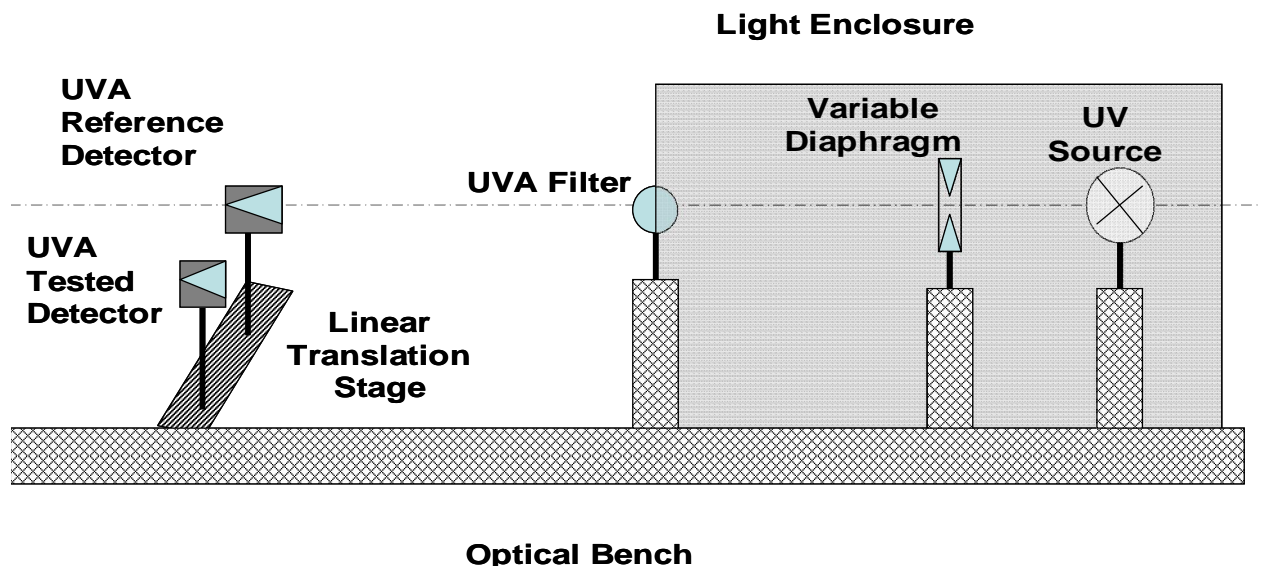


Fig. 1: Sketch of the used experimental apparatus.

### 7. Reference standards and reference materials required

Calibration methods of these kinds of instruments are detector or source method. In this procedure calibration of UVA meters carried on using substitution method following the requirements of ISO 17025. This rise the importance of using calibrated radiometer at range of interest. Also the filter spectral transmission range is very important to be known. In this method the radiometer to be calibrated is compared with the standard radiometers

when both are exposed to the same irradiance from a given source.

### 8. Environmental conditions required and any stabilization period needed:

Stabilization of environmental condition is a common in calibration procedures. In this procedure the environmental condition is not critical but the calibration temperature at which the reference radiometer was calibrated should be followed other wise temperature correction must be applied.



**9. Description of the procedure:**

9.1- The test radiometer should be checked for battery level, irradiance range, and dark current.

9.2- Use the alignment laser to align radiometers head so that the irradiance is normal to its geometrical center. Attention should be taken on the alignment of the tested radiometer and its plane position must be the same as the standard radiometer.

9.3- Method of recording:

9.3.1-The UV lamp should be turned on for 30 minutes until it became stable.

9.3.2-Check the environmental condition to be matched with that obtained on the standard radiometer was calibrated, otherwise temperature correction applied.

9.3.3-Adjust each radiometer before calibration testing to indicate zero with no irradiance on its head.

9.3.4-Record the irradiance value given by the standard meter. Replace the standard radiometer head with the head of the tested radiometer and record its reading. Then use the standard radiometer head again to perform the original reading.

9.3.5-Reading of both radiometers at different irradiance levels which cover the range of the tested radiometer can be tabulated by a way that clearly show readings of standard radiometer, reading of tested radiometer, and the repetition of measurements at each irradiance level.

9.3.6-Cover the radiometer head between each recorded measurements, at each successive point of calibration expose the heads to the source for sufficient time for the reading to settle before recording the reading.

Notes:

- 1- Special precautions should be taken to prevent stray irradiance, i.e. irradiance which does not come directly from the source but is scattered off the walls, floor and ceiling, from reaching the radiometer head.
- 2- Safety precautions of UV exposure should be taken.

**10. Sources of Uncertainty:**

- 1- Calibration uncertainty of the reference detector.
- 2- UV source stability.

- 3- Stray radiation.
- 4- Uncertainty of meter alignment and positioning.
- 5- Calibration uncertainty of photocurrent amplifier if there.
- 6- Mismatch of the measured radiometer with respect to the standard one.
- 7- Resolution of the measured radiometer.
- 8- Repeatability of photocurrent reading

**Conclusion:**

UVA radiometers mentioned in this paper are basically instruments with low accuracy due to its diminution of spectral resolution. Two basic procedures can be used to calibrate it. Here the procedure of calibration use the detector based method so; it is completely independent on the source of UV, but highly depending on the calibrated UV radiometer. It is clear that for calibration of UV radiometers using detector method may follow steps discussed before to achieve applicable procedure with high accuracy of measurement and acceptable uncertainty level.

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4/1/2011

## Comparative Study of Structural Systems for Tall Buildings

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**Abstract:** An investigation has been carried out to examine the most common structural systems that are used for reinforced concrete tall buildings under the action of gravity and wind loads. These systems include “Rigid Frame”, “Shear Wall/Central Core”, “Wall-Frame Interaction”, “Outrigger”, and “Tube in Tube”. The basic modeling technique and assumptions are made by “ETABS” Program, in 3-D modeling. Design considerations are made according to “ACI 318-05” Code and “ASCE 7-05” Standard. This comparative analysis has been aimed to select the optimal structural system for a certain building height. The structural efficiency is measured by the volume of concrete of main elements, structural period, and base shear values. The recommendations for each structural system are based upon limiting the wind drift of the structure, minimizing the cost of wind force resisting elements, and increasing the lateral stiffness.

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**Keywords:** Tall buildings; structural systems; wind loads; and drift control

### 1. Introduction:

The achievement of structural system for tall buildings is not an easy task. Where, as building height increases the importance of lateral loads action rises in an accelerating rate. There are two types of lateral loads, wind and seismic loads. Wind load presents the most critical lateral loading for modern tall buildings, which have lightweight skeletons that cause uncomfortable horizontal movements for occupants. Also, wind is not constant either with height or with time and is not uniform over the sides of a building. So, windy weather creates a variety of problems in tall buildings, causing concern for buildings owner and engineers alike. Where, excessive vibration due to this load is a major obstacle in design and construction of a modern tall building. it should be limited to prevent both structural and nonstructural damage.

### 2. Main Objectives

Comparison between different types of tall buildings structural systems for certain building heights was introduced by “Fazlur Khan” (Wolfgang Schueller, 1977), and “The Council on Tall Buildings and Urban Habitat” (CTBUH, 1980), both was investigated according to optimum performance for a given height or number of stories only.

1. Recommending a structural system for a certain building height, with the intention of limiting the wind drift to acceptable limits without paying a high premium in the quantity of structural material.

2. Presenting a comparative analysis between the most common structural systems of tall buildings built around the world within the past decades according to volume of concrete, structural period and base shear values.
3. Conceiving and applying the structural systems to extremely tall buildings is a practical demonstration of the engineer's confidence in the predictive ability of the analysis by commercial software.

### 3. Case-Study

The case-study is a regular-shaped symmetrical plan with dimensions 30x30 m. In all structural modeling, slab spans are assumed to be 6 m, arranged in five bays in each direction, as shown in Fig. 1. The plan has a 6x6 m central core opening. The storey height is assumed to be 3.5 m. The analysis used is a three-dimensional analysis of detailed finite element models. The columns and beams were represented by frame- type element, while shear walls and core components were represented by shell-type element.

### 4. Common Structural Systems For Tall Buildings

Table 1(a) and 1(b) introduces the five major structural systems used in most of the famous buildings built around the world, they are also discussed in the study.

### 5. Main Assumptions for the Analysis

1. Material: Concrete is assumed to behave linearly elastic. The modulus of elasticity  $E_c$  will be taken as

4700  $f'_c$ . Where, the specified compressive strength of concrete  $f'_c$  is assumed equal to 40 Mpa, as used in practical applications of tall buildings. The concrete cover will be taken as 4 cm (ACI 318-05, 2005).

2. Participating components: Only the primary structural components are assumed to participate in the overall behavior. The effects of secondary structural components and nonstructural components are assumed to be negligible; these include, staircases, partitions, cladding, and openings.

3. Floor slabs: are assumed to be rigid in plane, with thickness equal to 30 cm in all models. This assumption causes the vertical elements at any floor level undergo the same components of translational displacement and rotation in the horizontal plane.

4. Cracking: The effect of cracking in reinforced concrete members due to flexural tensile stresses is represented by reducing moment of inertia, as mentioned in (ACI 318-05, Section 10.11.1).

5. Constraints: Supporting bases of all structural models are fixed supports.

6. Loading:

§ Gravity Loads: Dead load is taken as 3 kN/m<sup>2</sup>, The building weight and its content is considered in the dead load and calculated based on material densities by the program. While, live load is taken as 2 kN/m<sup>2</sup> (ASCE 7-05, 2005).

§ Wind loads: will be developed according to "ASCE 7-05" standard.

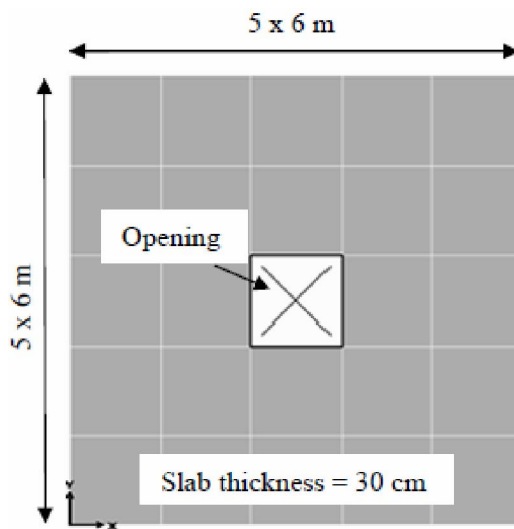


Fig.1 General layout for all structural models plans

## 6. Defining Wind Loads in "ETABS" Program

The design wind loads for buildings at height  $Z$  above ground level was determined according to the following Eq.(1), (ASCE 7-05, 2005).

$$P = q_z G_f C_p (\text{windward}) + q_h G_f C_p (\text{leeward}) \quad (1)$$

Where,  $G_f$  is the gust effect factor that accounts for the dynamic interaction between the flowing air and the structure.  $C_p$  is a pressure external coefficient, typically equal to 0.8 and 0.5 for the windward and leeward sides, respectively.

The velocity wind pressure  $q_z$  at height  $Z$  and the velocity suction  $q_h$  are given by Eq.(2) and Eq. (3), respectively.

$$q_z = 0.00256 K_z K_{zt} K_d V^2 I_w \quad (2)$$

$$q_h = 0.00256 K_h K_{zt} K_d V^2 I_w \quad (3)$$

The previous equations contain some factors used in defining wind loads in "ETABS" program. These factors will be introduced, as follows:

- Velocity Pressure Exposure Coefficients  $K_z$  and  $K_h$  are used for weighting the probability of critical wind orientation for sites with significant directional wind amplitude variation within a hurricane hazard region. "ETABS" calculate them by one from the following Eq.(4) or Eq.(5).

$$K_z = 2.01 (z / z_g)^{2/3} \quad \text{for } 15 \text{ ft} \leq z \leq z_g \quad (4)$$

$$K_z = 2.01 (15 / z_g)^{2/3} \quad \text{for } z < 15 \text{ ft} \quad (5)$$

Where,  $\alpha$  is 3-S gust-speed power law exponent, (See ASCE 7-05, Table 6.2)  $z_g$  is the nominal height of the atmospheric boundary layer.

- Three exposure categories (B, C, and D) are defined according to (ASCE 7-05, Section 6.5.6.1). In summary, exposure B corresponds to surface roughness such as urban and suburban areas, exposure C to flat open country, while exposure D represents flat unobstructed area and water surfaces. In this study, exposure C will be applied to all cases.
- The wind importance factor  $I_w$  is used to adjust the return period for a structure based on its relative level of importance. This study is assumed that all buildings are classified category II, so  $I_w$  will be taken equal to 1.0
- The topographic factor  $K_{zt}$  reflected the speed-up effect over hills and escarpments. This study is assumed that all buildings does not subject to these sudden topography changes. So, this factor will be taken equal to 1.0

Table 1(a) Major structural systems for tall buildings

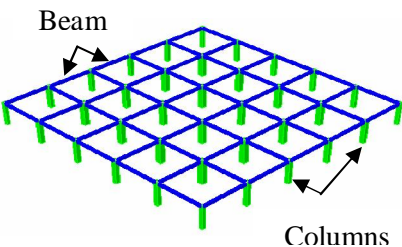
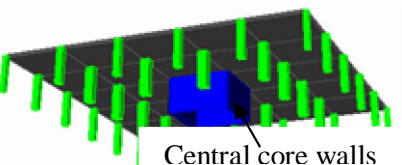
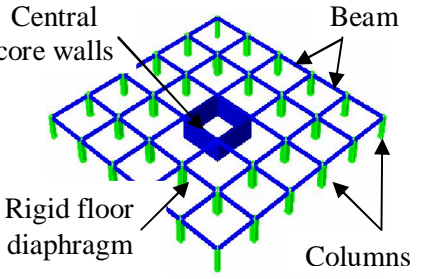
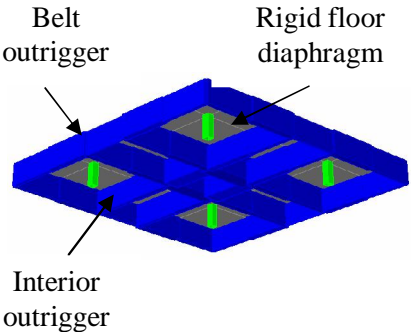
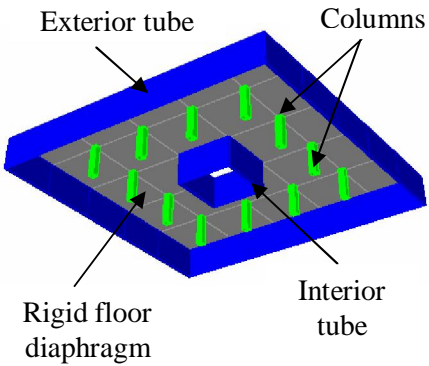
System & Configuration	Structural Elements	Usage	Behavior
<p>1. Rigid Frame</p> 	Columns and girders connected by rigid joints. Joints must have sufficient rigidity to resist lateral and gravity loads (Bryan Stafford Smith and Alex Coull, 1991).	Suited for reinforced concrete buildings, because the inherent joints rigidity, and used also in steel buildings, but connections tend to be costly.	Under gravity loads, The frame continuity reduce the positive moments in the center span of the girder. Under lateral loads, The lateral stiffness is provided by the bending stiffness of the columns, girders, and connections. In tall frame, it is governed by the axial rigidity of the columns (Wolfgang Schueller, 1977).
<p>2. Shear Wall/Central Core</p> 	It is a vertical continuous stiffening elements, that deform in bending mode.	Used in reinforced concrete buildings and suited to residential buildings and hotels.	Shear walls act as vertical cantilevers when responding to lateral loads, its response depends on the interaction between the horizontal floor and the vertical wall.
<p>3. Wall-Frame Interacting</p> 	A combination of shear walls and rigid frames.	Suited for reinforced concrete buildings, and used also in steel buildings,	Shear-mode profile of frames combined with parabolic mode of walls. The two systems are forced to deflect in the same way by rigid floor diaphragm. The upper part of wall is restrained by the frame, whereas at the lower part, the shear wall or truss restrains the frame.

Table 1(b) Major structural systems for tall buildings (Cont.)

System & Configuration	Structural Elements	Usage	Behavior
<b>2. Outrigger Systems</b>  <p>The diagram illustrates two types of outrigger systems. In (a) Interior outrigger, blue beams (outriggers) connect a central core (green columns) to exterior columns. In (b) Belt outrigger, blue beams connect the core to exterior columns around the perimeter of the floor slab. Labels include 'Belt outrigger', 'Rigid floor diaphragm', and 'Interior outrigger'.</p>	(a) Interior outrigger: Outriggers are connected directly to the core and to exterior columns	Used in reinforced concrete and steel buildings.	Outriggers restrain the rotation of the core and convert part of the moment in the core into a vertical couple at the columns (columns restrained outriggers)
	(b) Belt outrigger: Outriggers are at the exterior edges (not connected directly to core)	Used in reinforced concrete and steel buildings.	Floor diaphragms transfer the moment from the core to outriggers in the form of a horizontal couple. The outriggers convert the horizontal couples into vertical couples in exterior columns (Bungale S. Taranath, 1998)
<b>5. Tubular Systems</b>  <p>The diagram shows a tubular system with an 'Exterior tube' and an 'Interior tube' connected by a 'Rigid floor diaphragm'. 'Columns' are shown within both tubes. Arrows point to each component.</p>	Closely spaced columns and deep spandrels to tie the columns around the perimeter of the building. The floor diaphragm connecting the exterior and interior tubes .	Suited for steel buildings.	Floor slabs acts as a rigid diaphragm, distribute the lateral loads to the exterior and interior tubes according to their stiffness. Frames parallel to the lateral loads act as webs (resist shear), while the frames normal to the loads act as the flanges (resist bending).



- Wind directionality factor  $K_d$  varies depends upon the type of the structure. This factor shall only be applied when used in conjunction with load combinations specified in “ASCE 7-05” standard, Sections 2.3 and 2.4, as in this study. The  $K_d$  factor equal to 0.85 for most types of structures. This wind directionality factor accounts for two effects:
1. The reduced probability of maximum winds flowing from any given direction.

2. The reduced probability of maximum pressure coefficient occurring for any given direction.
- The basic wind speed  $V$  will be taken equal to 100 mph (ASCE 7-05, 2005).
  - When “ETABS” calculate the design wind loads, it creates all cases specified in “ASCE 7-05” standard. There are four cases shown in Fig. 2.

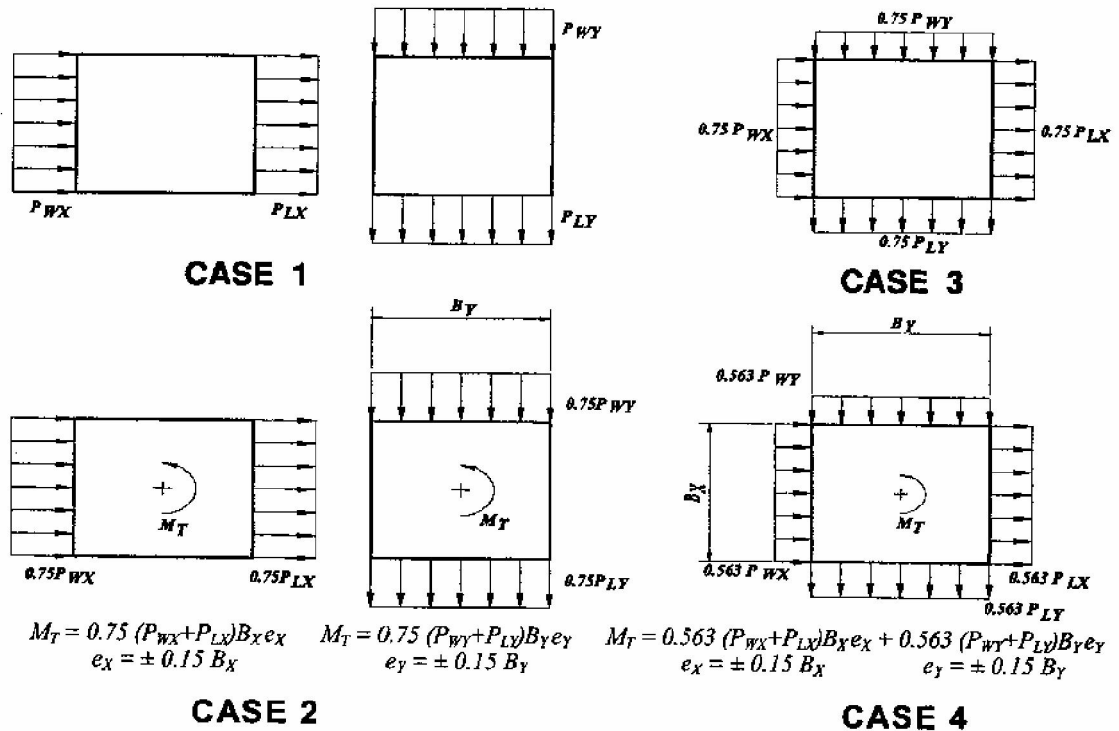


Fig. 2 Design wind load cases (ASCE 7-05, 2005)

“ETABS” program wind loading calculations was validated with manual calculations before analyzing the structural models (El-leithy, 2010).

## 7. Preliminary And Final Analysis

Structural systems have been applied to the considered case-study using two models.

§ Preliminary model: is constructed based upon designing the wind force resisting elements according to “ACI 318-05” Code.

§ Final model: If the lateral wind drift within any storey in the preliminary model exceeds the allowable limits, an inspection of the components of drift will indicate which members should be increased in size to most effectively limit the drift.

## 8. Allowable Lateral Wind Drift

§ Total building drift: must be limited to ensure the comfort of the occupants and the protection of mechanical and architectural systems. “ASCE 7-05” standard has recommended that the maximum sway shall be less than 0.002 times the building height for normal wind pressure.

Storey drift: is defined as the difference between the lateral displacements of one level relative to the level below (ASCE, 1988), must be limited to minimize damage of cladding and nonstructural walls and partitions, “ASCE 7-05” standard has recommended that it shall be less than 0.0025 to 0.002 of the storey height

## 9. Results and Discussions

### 9.1 Rigid frame results

Only 10 stories structure (35 m high) has allowable wind drift. While, 20 stories structure (70 m high) and more have a drift more than the allowable limits, as shown in Fig. (4a). So, the sizes of wind force resisting elements needed to be increased (Fig. 4b). Thus, its stiffness is increased, as shown in Fig. (4c). For more heights, wind drift values reached double of the allowable limits. This required an increased volume of concrete that would exceed other structural costs. Also, it is argued that as the height increases beyond 10 stories, the wind drift starts controlling the design. Considering the base shear, the sizes of columns and beams increases largely toward the base with the increase of shear storey. Figure 4d shows the values of base shear.

### 9.2 Shear wall/central core results

In general, this system has several additional advantages with respect to rigid frame system in limiting the wind drift. However, the wind drift is still more than the allowable limits in 20 stories structure, as shown in Fig. 5a. Thus it needs an increase in the volume of concrete, as shown in Fig. (5b). If we used this system for much taller building, the cost of the building will highly increase and a large area will be lost in the lower stories due to huge cross sections area in order to limit the wind drift. Considering the structural period (Fig. 5c), there are a big step in the values of 20 stories and taller height which reflects the inefficiency of this system. The values of base shear in shear wall/central core system are less than that in rigid frame system by a small difference, about 5%, in case of comparing the final models.

### 9.3 Wall-frame interaction results

10 and 20 stories structures have conservative values of wind drift with respect to the allowable limits, as shown in Fig. 6a. While, 30 stories structures need a small increase in the volume of concrete to limit the lateral drift (Fig. 6b). It is uneconomic to use this system for 50 stories structures. Considering the structural period, as shown in Fig. (6c), a change in stiffness with the total height occurs because the top flexibility of the central core walls is proportional to the cube of the height, whereas the flexibility of the frames is directly proportional to its height. The external shear will be distributed in proportion to shear walls and frames stiffness, shear walls capture a large portion of base

shear with respect to frames, approximately from 78 to 94%.

### 9.4 Outrigger results

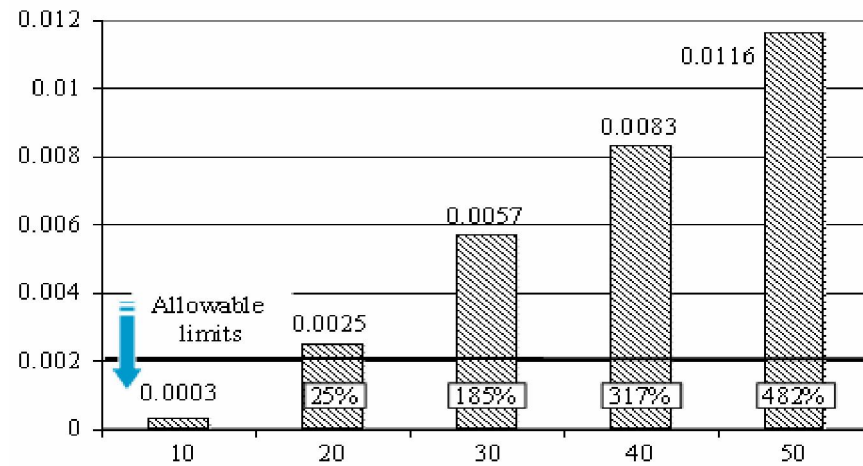
Outrigger system offers lot of benefits in resisting wind loads in tall buildings. Where, a significant reduction in the wind drift can be achieved, in case of using it in stiffening central core structures, as shown in Fig. (7a). The location of the outrigger is the main factor in limiting the wind drift. After many iterations, the final model for 20 stories central core structure the outrigger will be placed at the top of the structure, for 30 stories at the mid-height. for 40 stories, two of both interior and belt outriggers will be used, at the one third and two thirds of height. 50 stories was stiffened by three outriggers at one quarter, half quarter, and three quarters with belt outrigger placed at the middle, while 60 stories stiffening by four of both interior and belt outriggers. This concept is clear when comparing the volumes of concrete of central core with and without outriggers, as shown in Fig. (7b). Outrigger system is effective in increasing the structure's flexural stiffness, as shown in Fig. (7c), but it does not increase its resistance to shear, which has to be carried mainly by the core. The values of base shear of the two systems are shown in Fig. (7d).

### 9.5 Tube in tube results

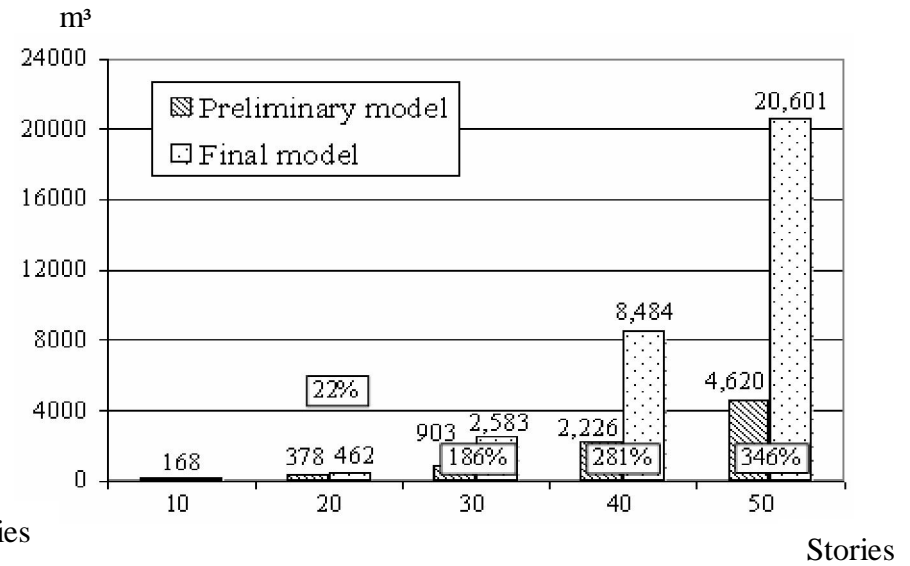
Tube in tube system has been used for increasing the effective depth of central core structures. The maximum wind drift values of tube in tube system and central core system are shown in Fig. (8a). Figure 8b. shows the volumes of concrete of both tube in tube and central core systems. The structural period values of both systems are shown in Fig. (8c). The effect of shear lag on the tube action occurs in 60 stories structure (210 m high), results in nonlinear pressure distribution along the columns envelop, the columns at the corner of the building are forced to take a higher share of the load than the columns in between. Figure (8d) shows the results of base shear with respect to number of stories.

## 10. Comparison between the Five Structural Systems

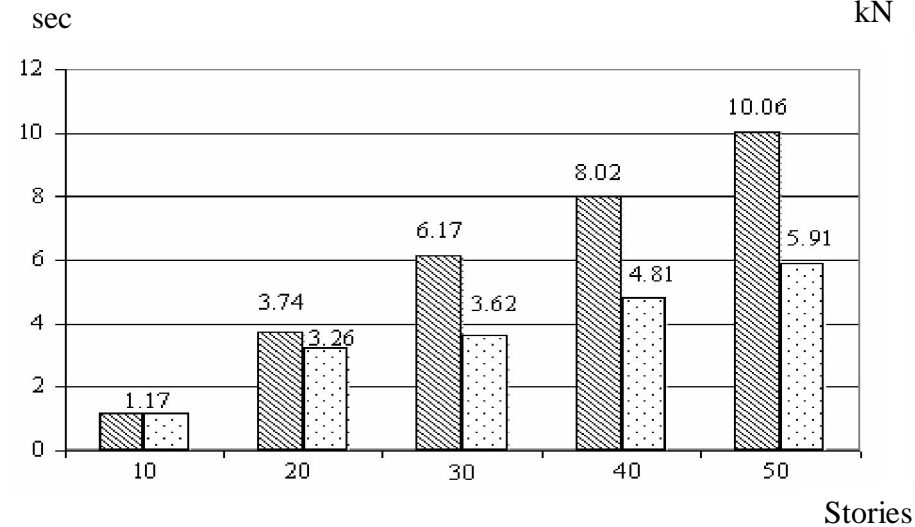
In this study, figure 9a, 9b and 9c represent a comparison between the most commonly used structural systems, due to the volume of concrete, structural period, and base shear values for different number of stories.



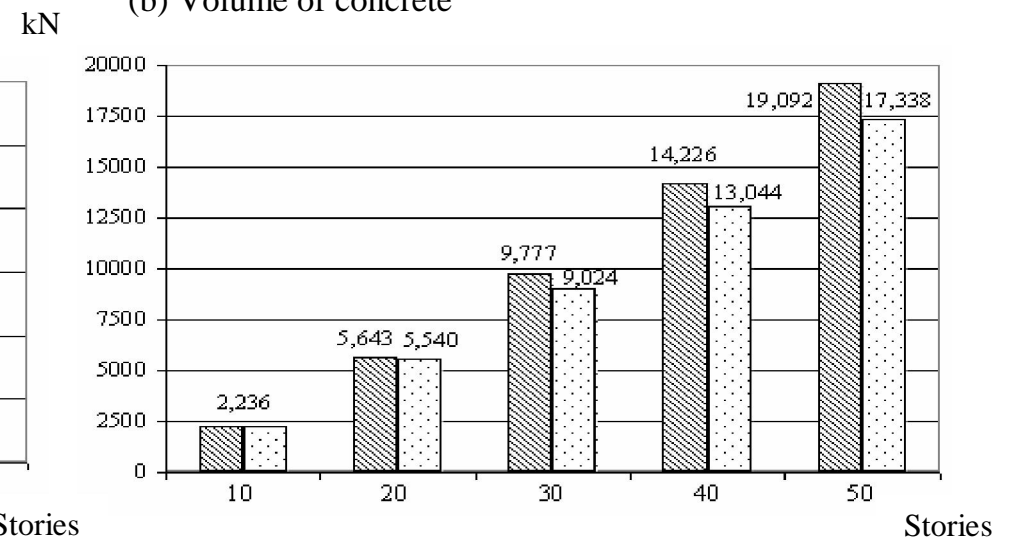
(a) Maximum wind drift



(b) Volume of concrete



(c) Structural period



(d) Base shear

**Fig. 5 Shear wall/central core results for different number of stories**

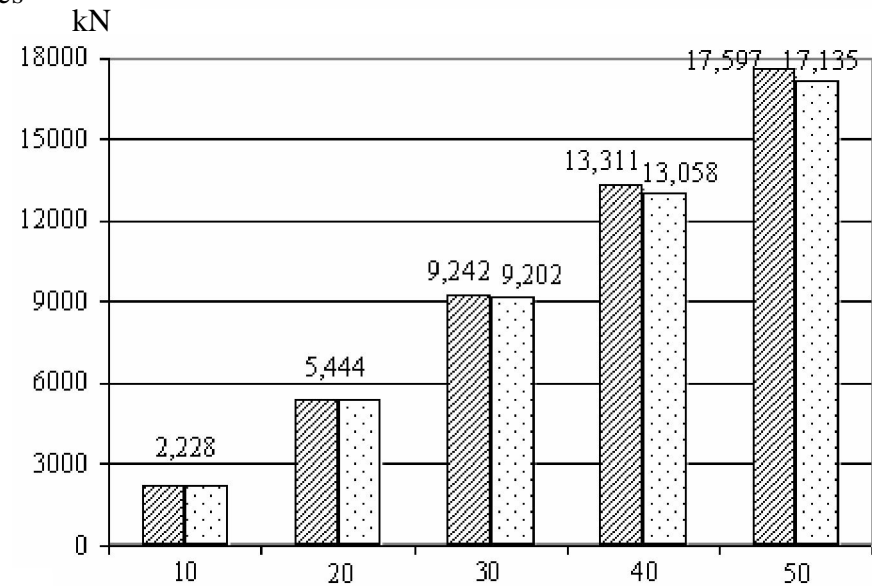
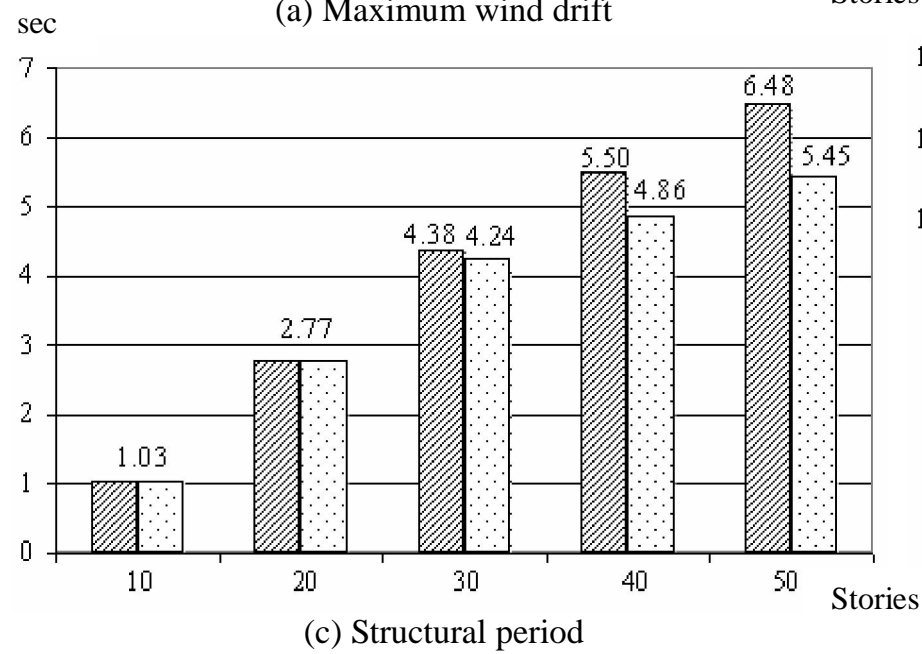
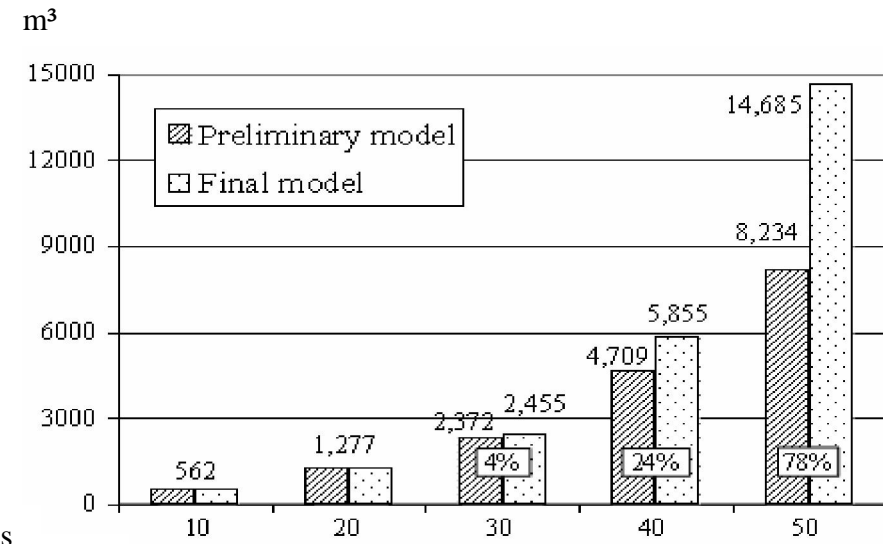
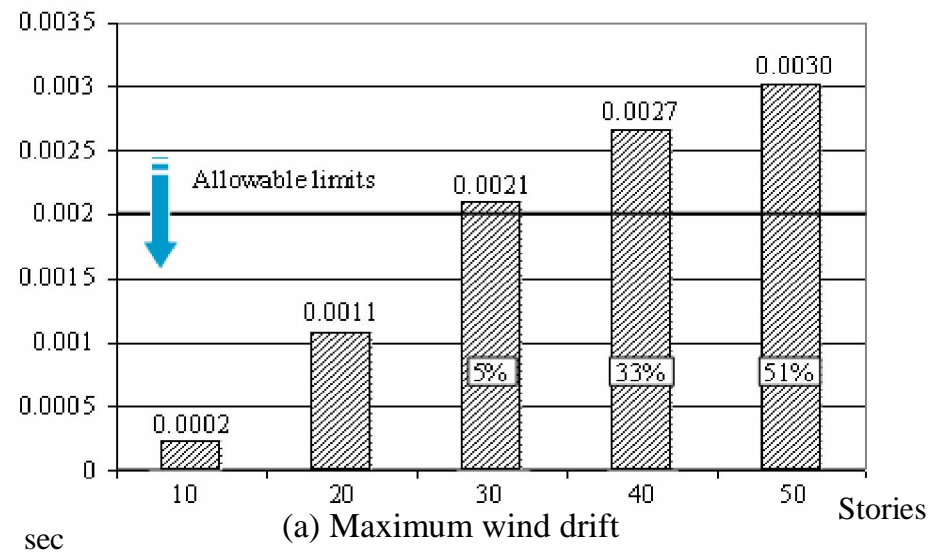
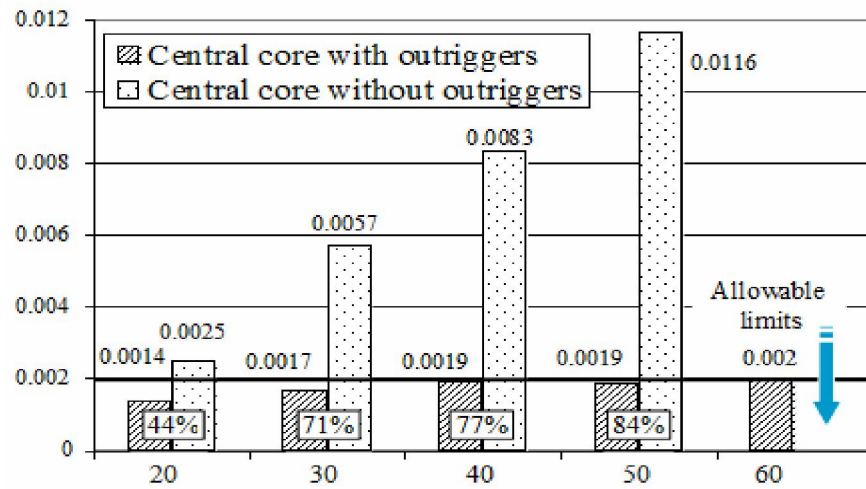


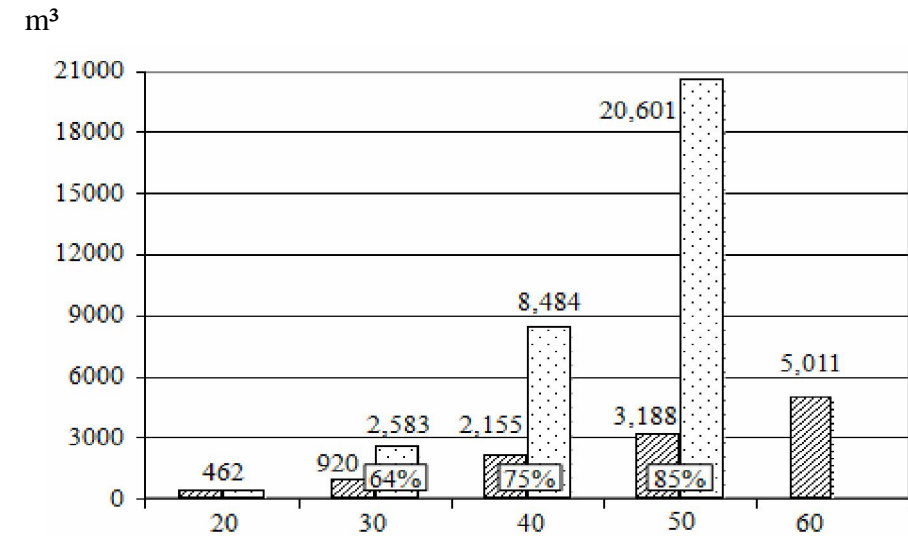
Fig. 6 Shear wall-frame interaction results for different number of stories





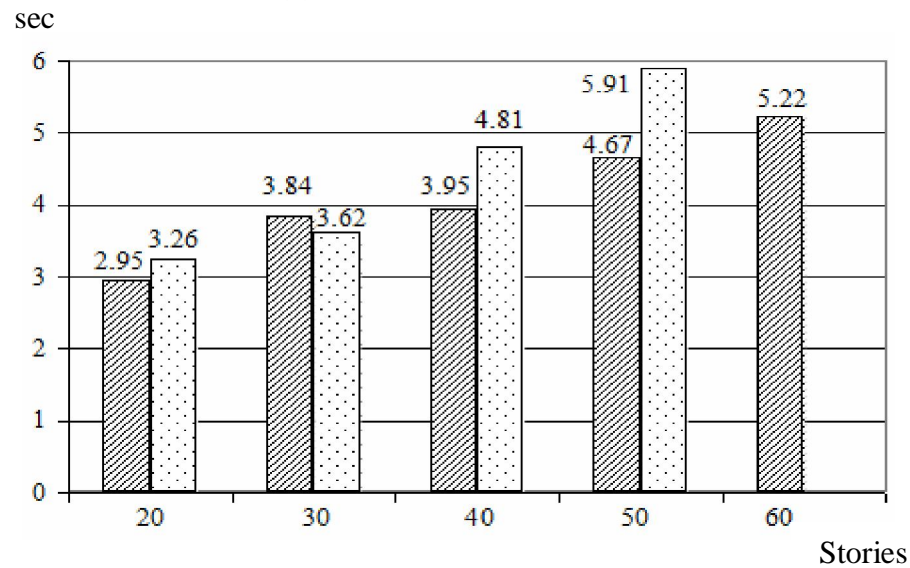
(a) Maximum wind drift

Stories



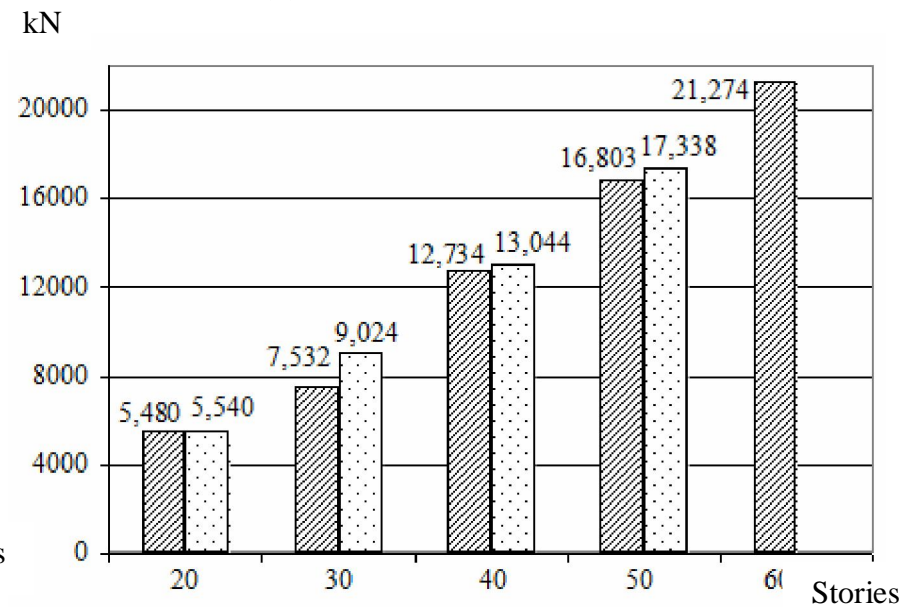
(b) Volume of concrete

Stories



(c) Structural period

Stories



(d) Base shear

Stories

Fig. 7: Results of central core with and without outriggers for different number of stories



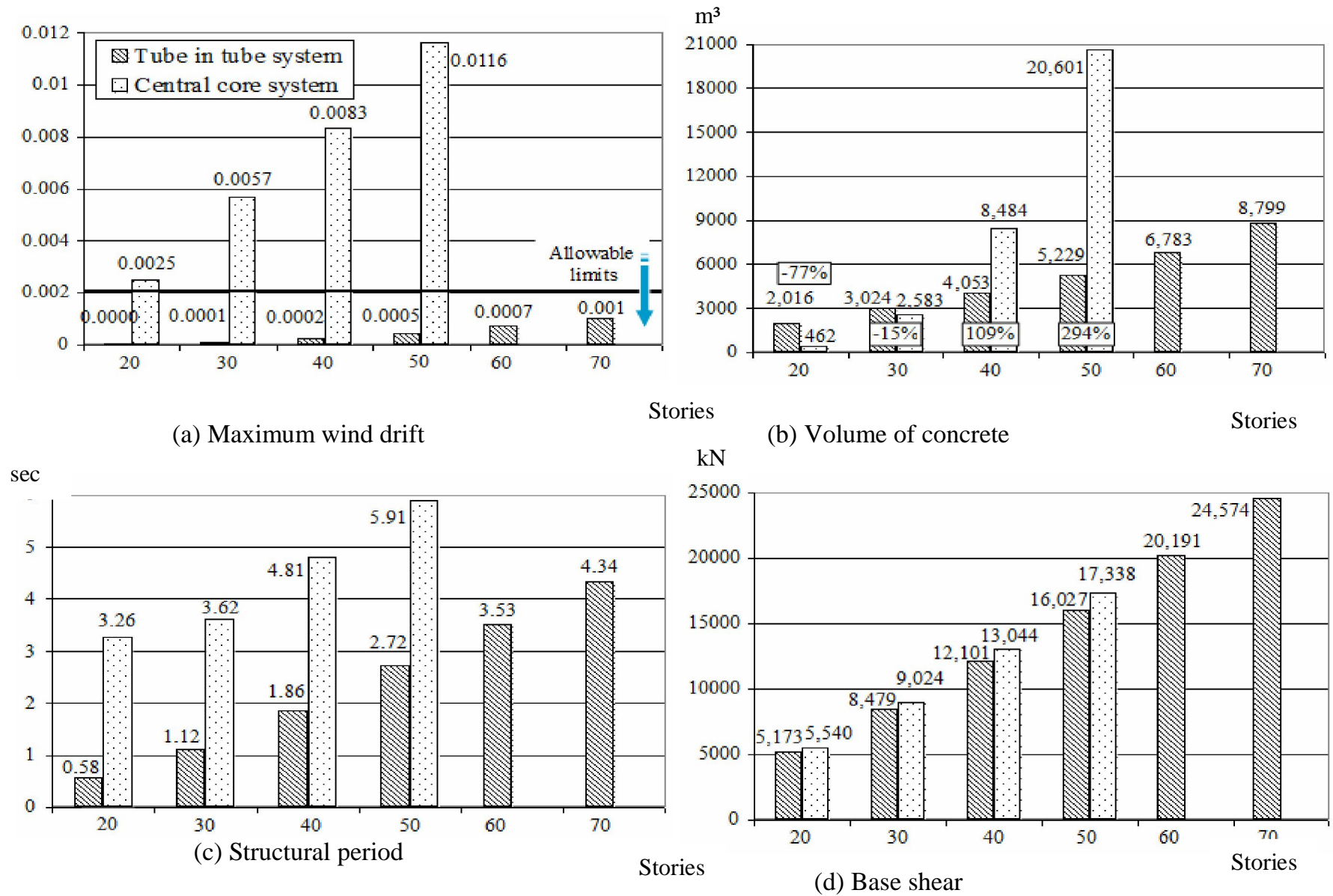


Fig. 8: Results of tube in tube and central core systems for different number of stories

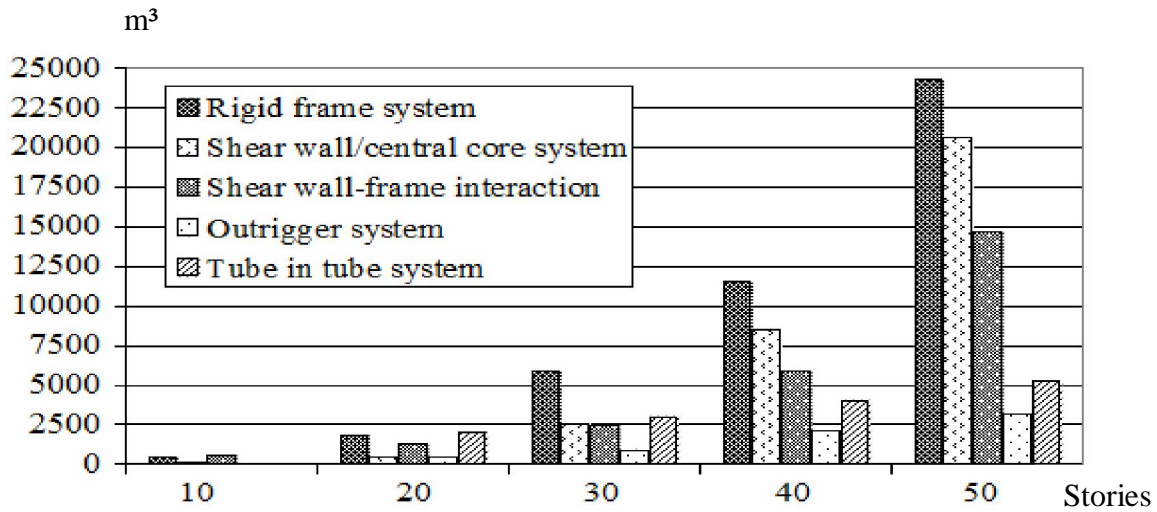


Fig. 9a: Comparison between the five systems due to volume of concrete

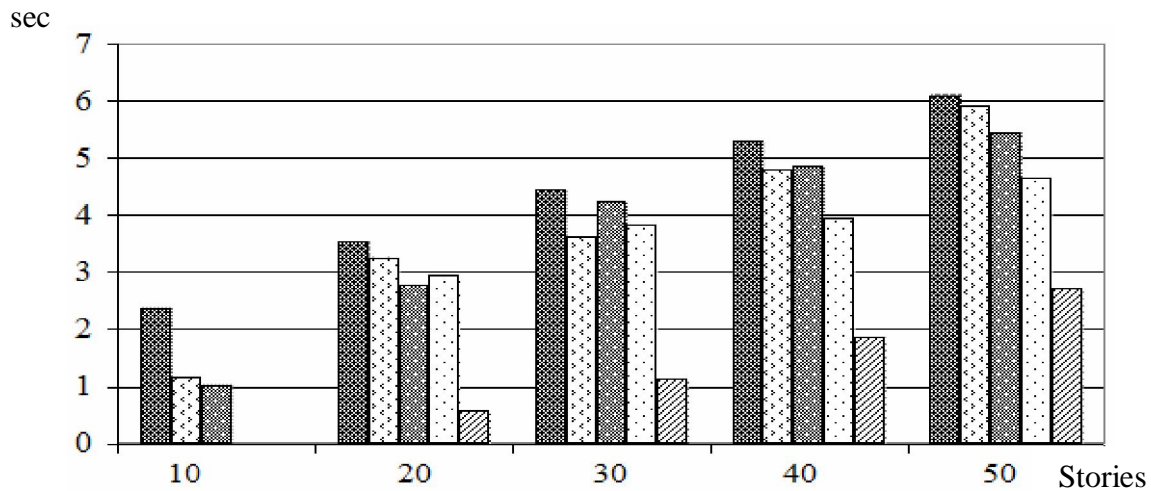


Fig. 9b: Comparison between the five systems due to structural period

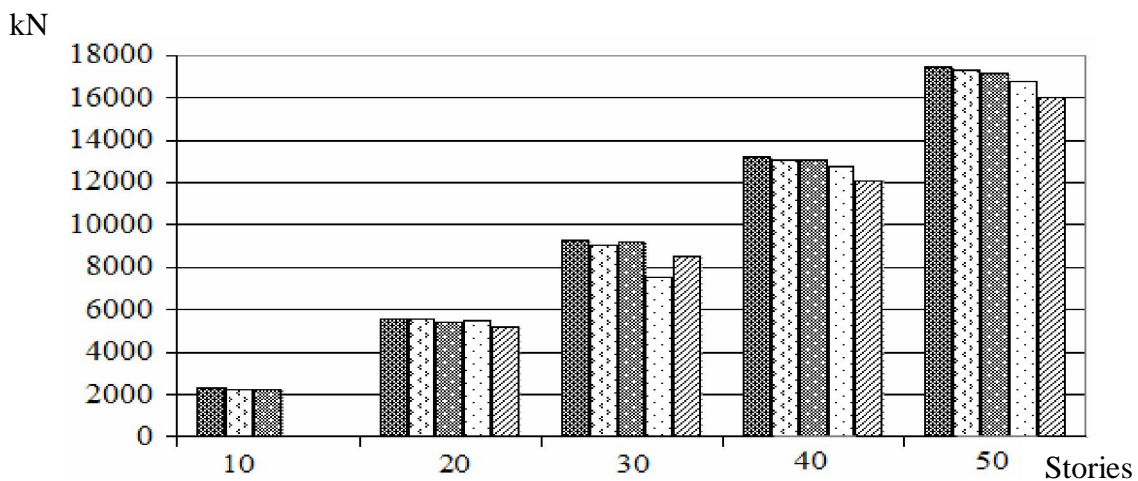


Fig. 9c: Comparison between the five systems due to base shear

## 11. Conclusions

The following conclusions are based on the results obtained in this study:

### 11.1 General conclusions

1. Under the effect of wind loads, as the height of the structure increases, the lateral deflection and the overturning moment at the base increase.
2. The volume of concrete increases almost linearly with the height of the structure with respect to gravity loads. While, for resisting wind loads the volume of concrete increases at a drastically accelerating rate.
3. Tall buildings almost always require additional structural material, in order to limit the lateral deflection and resist the overturning moment, over and above that required for gravity loads only.
4. The key idea in limiting the wind drift in a tall building is by changing the structural form of the building into something more rigid and stable to confine the deformation and increase stability.
5. The stiffness (rigidity) and stability requirements become more important as the height of the structure increases, and they are often the dominant factors in the design.
6. Computer programs have given the structural engineer the tools to respond to the changing in architecture with daring structural solutions.

### 11.2 Structural systems conclusions

The main conclusions of this comparative study, concerning the efficiency of the presented five structural systems and the ability of each system in limiting the wind drift for a certain building height, can be summarized in the following:

#### 11.2.1 Rigid frame system

- § Recommended up to 20 stories (70 m high).
- § The relatively high lateral flexibility calls for uneconomically large members.
- § It is not possible to accommodate the required depth of beams within the normal ceiling space in tall rigid frame.
- § Not stiff as other four systems and considered more ductile and more susceptible to wind failures.

#### 11.2.2 Shear wall/central core system

- § Recommended up to 20 stories (70 m high).
- § More economic than rigid frame.
- § A great increase in flexural stiffness with respect to rigid frame.

#### 11.2.3 Shear wall-frame interactive system

- § More conservative for heights up to 20 stories (70 m high).
- § Recommended in the range of 30 to 40 stories (105 to 140 m high).
- § The benefits of this system depend on the horizontal interaction, which is governed by the relative stiffness of walls and frames and the height of the structure.
- § As the structure height and the stiffness of the frames increase, the interaction between walls and frames increases.
- § The major factor in determining the influence of the frames on the lateral stiffness of this system is the height.
- § As the structure height increases, the sharing of walls from the base shear decreases with respect to frames and more interaction induced between both of them.
- § Stiffness of this system came in between rigid frame and shear wall/central core systems in recommended heights (30 to 40 stories).

#### 11.2.4 Outrigger system

- § Recommended in the range of 20 to 60 stories (70 to 210 m high).
- § The most economic system.
- § Created a wider effective system for reducing the overturning moment in the core structures.
- § The beneficial action is a function of two factors:
  1. The stiffness of the outrigger  
(Varies inversely with the outrigger distance from the base)
  2. Its location in the building.
- § An effective system in case of finding out at what level the outriggers should be placed in order to have a maximum impact on the wind drift.
- § Very effective in increasing the structure's flexural stiffness, but it does not increase its resistance to shear, which has to be carried mainly by the core.

#### 11.2.5 Tube in tube system

- § Recommended in the range of 30 to 70 stories (105 to 245 m high) & more.
- § The most stiff system.
- § Much more conservative values for wind drift.

## 12. Suggested Systems For Different Heights

Table 2 demonstrates the recommended structural systems for different heights. This table is organized according to the structural efficiency in limiting the wind drift as well as the cost and stiffness of the structure. These suggestions provide a direction to structural engineers for optimum system selection.

**Table 2 Suggested systems for different heights**

Height	Suggested System
10 stories (35 m)	Rigid frame, Shear wall/central core
20 stories (70 m)	Shear wall/central core, Outrigger
30 stories (105 m)	Wall-frame interaction, Outrigger
40 stories (140 m)	Wall-frame interaction, Outrigger, Tube in tube
50 stories (175 m)	Outrigger, Tube in tube
60 stories (210 m)	Outrigger, Tube in tube
70 stories (245 m)	Tube in tube

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3/25/2011

**Adult characteristics: The role of these features in their education**Azita Zamani<sup>1</sup> and Nahideh Erfanirad<sup>2</sup><sup>1,2</sup> Mahabad Branch, Islamic Azad University, Mahabad, Iran\*Corresponding author: [mehran11070@yahoo.com](mailto:mehran11070@yahoo.com)

**Abstract:** adult who is able to recognize their needs. He is who knows what will. Refers to individual adults in their lives cross and understand their responsibilities and has accepted the role is social. Adult learners are often those that distinguish each other and have many different targets at the same time and will follow a common challenge to fulfill the goals of building self motivation vectors as educational materials to learn and use the forge. In the past, usually one of the obstacles in the way of learning and development of adult education was being inflexible and time courses were programs. But now most countries have to consider that the speed limit of time and learning ability and facilities must be adults. Flexibility in time means that not only should the time classes and programs for adults is appropriate, but necessary facilities should be provided for independent study.

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**Keywords:** adult education, learning

**Intruduction:**

The most serious challenge will be to motivate low-skilled, under-educated adults within the working age population to seek further education. Simply expanding the number of providers and programs will not necessarily increase demand from the populations and communities where the needs are greatest. Deepseated social, economic and cultural barriers—many dating back generations—lead people to undervalue education. In addition, in many counties it is difficult for people to see a direct relationship between better education and better-paying jobs. Either there are no jobs available or many existing employers do little to emphasize the connection between better education and the possibilities for getting a job, keeping a job, or earning a higher wage. For many, getting more education and earning a high school diploma or a college degree has little positive meaning.

Only the negative consequences are obvious: getting more education often means leaving one's family and community for jobs and opportunities for advancement somewhere else. The future of Kentucky depends on uplifting the quality of life and economy of all of Kentucky. The social and economic costs of neglect of large parts of the state will drag down the rest of the state and seriously hinder its capacity to compete in the global economy. Much like strategies to curb epidemic, strategies to reduce illiteracy and raise the educational attainment of Kentucky's population must include both short-term efforts to face the immediate crises as well as long-term strategies to get at the underlying causes. Short-term crises include the imperative to keep

helping welfare clients make the transition from welfare to work within the constraints of federal and state mandates and the need to train workers for

immediate employer demands. Long-term prevention must address the underlying, persistent problems of the state's economic structure as well as the low awareness—if not appreciation—among segments of the population of the vital connection among education, employment, and improved standards of living.

Therefore, it is helpful to distinguish between at least these dimensions of the issue:

1. "Literacy" refers to the knowledge, skills, and competencies of individuals. The federal Adult Education and Family Literacy Act (Title II of the Workforce Investment Act)<sup>1</sup> defines literacy as "an individual's ability to read, write, speak in English, compute and solve problems, at levels of proficiency necessary to function on the job, in the family of the individual, and in society." Literacy is often defined in terms of specific domains such as "basic academic skills," "workplace skills," "life skills," "parenting skills," or skills

necessary to exercise one's rights and responsibilities for citizenship. Different dimensions of literacy are often categorized by terms that cluster several dimensions of literacy important for different clients. Examples include workplace literacy (combining both basic academic skills and workplace skills), and family literacy (combining basic academic skills and other skills essential for successful parenting).

2. "Education attainment" usually refers to the numbers of years of schooling completed or the level of credential (e.g., high school diploma or associate degree) an individual has obtained. Despite concerns about the meaning of credentials, there is a strong correlation between educational attainment and literacy.

3. "Literacy initiatives" often are defined in terms of the needs of a particular target group. These may be parents of young children, youth who have dropped



out of high school without earning a high school diploma, welfare recipients, persons with limited English-speaking ability, incarcerated adults, or adults in the workforce.

4. Other literacy initiatives are defined in terms of a particular educational service, strategy, or means to address a target population's literacy problems. "Adult basic education" and "family literacy" are examples. These initiatives are often defined in terms of a particular configuration of services for the target population (e.g., assessment and information and counseling services).

5. The term "lifelong learning" is often associated with "literacy." Lifelong learning is a means to the goal of maintaining necessary levels of literacy throughout one's lifetime. The goal of lifelong learning has implications for both individual adult's learning behavior as well as education policy and the design of the education system.

Goal six of the National Education Goals illustrates a broadly stated goal that incorporates expectations about both adult literacy and the kinds of policies and services that should be in place to improve literacy. Goal six, "Adult Literacy and Lifelong Learning," states that, "By the year 2000, every adult will be literate and possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship." The objectives related to this goal touch on several of the common elements of definitions listed above, for example:

- Different dimensions of literacy (e.g., academic and workplace skills),
- The level of education attainment (e.g., increasing the number of persons who complete postsecondary degrees),
- The needs of target groups (e.g., parents, minorities, or part-time learners),
- The need to increase the availability of particular educational services, strategies or means (e.g., accessibility of libraries to part-time learners or opportunities for parental involvement), and
- The importance of lifelong learning, both in the learning behavior of individuals and in the educational system's responsiveness to the needs of adult learners.

#### **Meaning adult:**

adult who is able to recognize their needs. He is who knows what will. Refers to individual adults in their lives cross and understand their responsibilities and has accepted the role is social. Adult learners are often those that distinguish each other and have many different targets at the same time and will follow a common challenge to fulfill the goals of building self

motivation vectors as educational materials to learn and use the forge.

#### **Concept of adult education:**

Several definitions of adult education has been done Community

- Adult Education is a)in the following examples are given of them. conscious effort by public institutions or voluntary organizations to promote community awareness comes action.
- adult education teaching is typically specific age group above the legal age) limits as formal and informal, voluntary and at different levels of time, place
- Adult Education is a process in which people who)and education is presented. somehow been cut course they consciously to change or advance their skills in information and do organized activities.
- Adult education includes all formal and informal training and volunteer after) school, which by experienced educators and aware of the system.

Educational materials on adult education with daily life, needs, goals, aspirations and past experiences of adults and their relationship helps to results learned in life and career are used.

#### **Adult characteristics:**

to understand the characteristics of adult learners, their mental and physical condition should be considered in the following referred to some of them.

#### **Operating speed:**

slow reaction in adults is natural that necessarily means reducing the logic and practice skills, not due to weakness and increased awareness of natural forces and their skills.

#### **Consciousness:**

no stimulus and incentives encouraging, despite inhibiting stimuli, slow transfer rate, mental, and weak inhibitors of natural forces (mostly visual and auditory) are factors that slow reaction affect individual mental and cognitive activities, but never able to understand, understanding and learning ability (which varies with the speed of learning) is not relevant.

#### **Health:**

what is most age, longer duration is necessary to be heard by listening issue. Why is that when elderly people and old could not hear well, their confidence and vulnerable to the possibility that negative beliefs about their find, they are great. Visual abilities can be like other people, usually decreases with age.

**Background of knowledge - skills and beliefs of adults:**

adults, social experiences, many have already learned different values and beliefs in their pronouns have stabilized, so changes in the new act very cautiously. The idea of such a manner that skill and applying them older and longer life is, Similar resistance to accept new ideas will be more and more severe. Thus, the adult criteria for the built and paid for their ideas and beliefs that are forming. Because of these criteria and the beliefs that they are afraid of failure, Therefore, to prevent it, sometimes against the resistance of new phenomena are only the material taught and its face that make reinforced concrete and tangible interference situation is.

**Quality, compensation, and support for teachers in adult education.**

As indicated earlier, a strength of adult education in Kentucky is the dedication of the many teachers often serving under difficult conditions, without adequate support, and often with compensation and benefits less than teachers in the public schools. Testimony before the task force characterized the work of adult educators as “missionary” work. Recognizing the seriousness of the adult literacy issue in Kentucky, it should be a major concern that the Commonwealth does not have a comprehensive approach to the professional preparation, development, and support of adult educators.

The challenge for Kentucky will be to move from a system that still depends on teachers with limited training in working with adults, to one in which professional competence in working with adults is a basic requirement. Any strategy to make this transition must involve both professional development and support for the teachers now in the field as well as a new system for a new generation of adult educators.

**Issues Beyond the Department of Adult Education and Literacy**

Beyond the issues relating directly to DAEL (Department of Adult Education and Literacy), the task force heard a number of concerns about the Commonwealth’s overall approach to adult literacy.

- Lack of coherent statewide leadership and coordination among multiple complementary initiatives aimed at the same problem.
- Lack of continuity in state leadership. Cited in particular was the difficulty sustaining a high level commitment to the issue long enough to make a difference because of

changes in priorities of the state’s political leaders. A high level of turnover in the leadership of the Department of Adult Education and Literacy has also contributed to the instability.

- Tendency to think of adult education as a separate categorical program rather than a strategy that cuts across the mission and responsibility of multiple Commonwealth programs and initiatives (e.g., early childhood education, welfare reform, economic development, and corrections).
- Multiple uncoordinated categorical federal initiatives that tend to drive (and fragment) policy for an overall state effort that is largely funded by Kentucky.
- A tendency to commingle and confuse different functions. The most important distinction is between functions focused on the needs of clients (adult learners, employers, communities, regions, and the Commonwealth as a whole) and functions associated with the operations and performance of providers. It is important that each of these functions receive attention, yet the tendency is for one (e.g., overseeing a network of providers) to drive out attention to overall system strategy.
- Inadequate coordination of services to meet the needs of individual adults, communities, employers, and regions is hindered by:
  - Vertical financing and regulatory relationships between separate federal and state programs and local providers and administrative units. These vertical relationships can hinder the horizontal coordination of services for individual adult learners, communities, and employers.
  - Turf wars among providers, local politics, and long-standing conflicts among neighboring counties.
- Inadequate links with and leverage of other public and private initiatives and investments to reach the target population. Major sources of help include employers, postsecondary education, and workforce development.
- Lack of a state financing policy and strategy for provider performance incentives and collaboration, and tax and other employer incentives for leverage of non-state resources.
- Lack of programmatic and administrative flexibility to meet the rapidly changing needs of adult learners, employers, regional economies, and communities.

**Conclusion:**

Types of content and educational resources in various parts of adult curriculum materials motivational book, course materials, supplementary materials, track materials (continued) participatory form and materials. Incentives aimed at providing content that audiences are produced primarily to attract different groups of adults interested in design, so that their participation in learning programs are encouraged. Motivational training materials for learners and have great importance even in support of successful applications over learners, planners and executors for educational programs is important.

Material often set different types of materials and educational content in books and pamphlets, books, training guides, trainers, equipment auxiliary audio, visual and material are included such that during actual teaching sessions, are used in the transmission and content but also to achieve the goals of making education programs are important.

Additional material for the next stage of learning often means to be expected when developing your learning skills Learners to increase awareness and enjoyment of reading and studying to operate.

To improve the quality of life, learning materials should reinforce the skills they acquired previous. This material should have access to information and provide new technology. should also have to make learning more fun. Additional materials should provide opportunities for literacy skills to read and to strengthen their cognitive awareness.

Track materials (continued) which increased literacy skills and knowledge gained is also effective in enriching learning environment for learners are important. Participatory materials to ensure the participation of learners in the learning process and codification are included out of class activities, dialogue, role playing, etc.

In traditional programs that the principles of psychology and curriculum planning, less attention is the form of content presentation ie codification and providing books, original format and have the dominant form, while for adult content that could have valuable experience in addition to writing, other ways also be provided Affect the selection of pictures and images related to the concepts and content produced by including them.

Some research findings that can be a learning process for the Guidelines for training operations are applied, is given below:

1- - Preparation for adults to learn how much he depends on previous learning. Knowledge that has accumulated because of an ability to absorb new information more person is. Past educational

experience features a diverse group of adult learners, the starting point of any activity on the diversity training is emphasized.

2- intrinsic motivation, learning a deeper and make them sustainable. When the need is met directly by the learning itself, what is learned, but is complementary learning. Creating a training activity in adult learning needs, learning ensures stable

3- Positive reinforcement (reward) learning to reinforce the negative (punishment) is more effective. Many adults because of negative experiences at the beginning of schooling, are weak and afraid. Feeling of success in adult learning for continuous learning and adult participation is essential.

4- To maximize learning, information must be provided an organized manner. Entries can be simple or complex can be arranged around related concepts are organized. Starting point for organizing content knowledge for adults and adults is linked to past experiences

The task force's policy recommendations are guided by these principles:

- Recognize that adult illiteracy is not an isolated problem but a fundamental barrier to every major challenge facing Kentucky. Without significant improvements in adult literacy the Commonwealth will be unable to make progress on issues such as early childhood education, education reform (elementary/secondary and postsecondary), economic development, and improving the health and well-being of Kentucky's families and communities.
- Shift from top-down implementation of a federal or state program to leading a statewide public campaign that depends fundamentally on a bottom-up commitment of communities, employers, and educational institutions. The campaign must engage all aspects of Kentucky life—all dimensions of state and local government, all education levels, the state's business and civic leaders, voluntary organizations, and all others whose work affects—or is affected by—the problem of adult illiteracy.
- The future of Kentucky depends on narrowing the disparities among counties by improving the adult literacy of the population in all regions of the state.
- Shift from an emphasis on providers to the needs of clients. Measure performance and progress

in terms of impact on the quality of life and economic well being of:

- Individuals
- Communities
- Regions
- The Commonwealth as a whole.
- Shift from an emphasis on programs and pilots to a focus on systemic impact on adult literacy in all counties of the Commonwealth.
- Focus on all adults who are in need of significant improvement in their knowledge and skills to be full participants in Kentucky's workforce and society, to develop and maintain healthy families, and to continue their education and training as necessary throughout their lifetimes.
- recognize multiple dimensions of the issue and, consequently, the importance and efficacy of multiple, separate but coordinated strategies aimed at the needs of different target populations, including, but not limited to:

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## Evaluation of antioxidant and antibacterial activities of Egyptian *Maydis stigma* (*Zea mays* hairs) rich in some bioactive constituents

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**Abstract:** The main aim of this research work is to evaluate antioxidant and antibacterial activities of Egyptian *Maydis stigma* (*Zea mays* hairs" corn silk") rich in some bioactive constituents. Antioxidant activity of ethanolic extract of both upper parts of corn silk (dark brown parts, exposed to the air) and lower parts (light yellow parts, not exposed to the air) was determined spectrophotometrically using total antioxidant activity and DPPH scavenging activity methods. It was found that upper parts were found to have the highest total antioxidant capacity (2.735 mg/g GAE equivalents). Regarding DPPH scavenging activity, it was found that upper parts were found to have the highest DPPH scavenging activity ( $IC_{50} = 0.704$  mg/ml). Antibacterial activity of ethanolic extract of both upper and lower parts of corn silk was screened against six human pathogenic bacterial species (*Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Escherichia coli* and *Streptococcus pyogenes*) by disk diffusion assay. The pattern of inhibition, activity index and proportion index were studied. It was found that both upper and lower parts of corn silk have no effect on bacterial species under investigation. Total phenolics, total anthraquinones and total flavonoids were estimated, in these regard, upper parts contain more amounts of these phytochemicals (180  $\mu$ g GAE/g F.W., 17.22  $\mu$ g/g F.W. and 119.47  $\mu$ g/g F.W. respectively) than lower parts of corn silk (151.33  $\mu$ g GAE/g F.W., 8.61  $\mu$ g/g F.W. and 101.66  $\mu$ g/g F.W. respectively).

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**Key words:** Corn silk, Antioxidant activity, Antibacterial activity, Phenolics, Anthraquinones, Flavonoids.

### Abbreviations:

GAE<sub>s</sub>: Gallic Acid Equivalent.

DPPH: 1,1-Diphenyl-2-picrylhydrazyl.

$IC_{50}$ : Concentration that gave 50% inhibition.

ppm,  $\mu$ g/g, mg/g and mm: part per million, microgram/gram, milligram/gram and millimeter respectively.

F.W.: Fresh Weight.

### 1- Introduction

Corn silk (*Maydis stigma* "*Zea mays* hairs") refers to the stigmas of the maize female flowers (Rosli *et al.*, 2008). Historically, it has been used as a therapeutic remedy for various ailments such as the inflammation of the urinary bladder and prostate as well as, treatment for irritation within the urinary system. To date, numerous commercially viable products prepared from corn silk are available (El-Ghorab *et al.*, 2007). Corn silk has long been reported in ancient literatures to be able to assist with prostate problems, bed-wetting, carpal tunnel syndrome, edema and obesity. It has also been used to lessen the effects of premenstrual syndrome, and said to promote relaxation. Corn silk was also reported to be useful to treat urinary infections and cystitis. It is helpful for frequent urination caused by irritation of the bladder and urethral walls as well as, for difficulty in passing urine, e.g. prostate disorders. It relaxes the lining of the urinary tubules

and bladder, thus relieving irritation and improving urine excretion (Steenkamp, 2003).

Another biological activities of corn silk constituents well cited in literatures. These include: antibiotic activity toward corn earworm by a flavone glycoside maysin (Maksimovic and Kovacevic, 2003), isolated flavonoids from corn silk were found to act as anti-fatigue and antidiabetic agents (Hu *et al.*, 2010). Traditionally corn silk has been used also as antilithiasic, uricosuric, and antiseptic. It is used for the treatment of gout, kidney stones, nephritis, and prostatitis, phenolics and flavonoids found in corn silk were thought to give it its antioxidant properties (Ebrahimzadeh *et al.*, 2008). Corn silk also improves nutrient contents and physical characteristics of beef patties (Rosli *et al.*, 2011).

In the present work, we will study some chemical compositions and some biological activities of Egyptian corn silk (which is considered till now in our country as a waste regardless its medicinal and economic importance). Corn silk was divided

"according to morphological differences" to upper parts of corn silk (dark brown parts, exposed to the air) and lower parts (light yellow parts, not exposed to the air) in a trail to find differences also between these parts regarding their antioxidant activity, antibacterial activity against some human pathogenic bacteria, in addition to phytochemical screening, total phenolics, anthraquinones and flavonoids.

## 2- Materials and methods

### Plant materials:

Upper parts of Egyptian corn silk (dark brown parts, exposed to the air) and lower parts (light yellow parts, not exposed to the air) were used as plant materials for biological and chemical investigations.

### Antioxidant bioassay:

Total antioxidant activity was performed using phosphomolybdenum reagent solution method of Prieto *et al.*, (1999) and adopted by Kumar *et al.*, (2008). The antioxidant capacity was expressed as Gallic Acid Equivalent (GAE) by using the standard Gallic acid graph.

DPPH (1,1-diphenyl-2-picrylhydrazyl) scavenging activity was carried out by using the method of Gursoy *et al.*, (2009).

### Tested microorganisms:

Antibacterial activity of ethanolic extracts of both upper and lower parts of corn silk was investigated against six human pathogenic bacterial isolates, obtained from Clinical Pathology Department, Faculty of Medicine (Kasr El-Eini) Cairo University, Egypt. These included three gram-negative bacteria including *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) and *Klebsiella pneumoniae* (ATCC 700603), three gram-positive bacteria including *Streptococcus pneumoniae* (ATCC 49619), *Staphylococcus aureus* (ATCC 25923) and *Streptococcus pyogenes* (ATCC 19615). The purity and viability of cultures were checked by culturing on nutrient agar slants, incubated at 37°C for 24 hours. Cultures were subcultured regularly (every week) and stored at 4°C (Yaacob and Tolba, 2006 and Arya *et al.*, 2010).

### Inoculum preparation:

A loopful of isolated colonies was inoculated into 4 ml peptone water and incubated at 37°C for 4 hours. The turbidity of actively growing bacterial suspension was adjusted to match the turbidity standard of 0.5 MC Farland units prepared by mixing 0.5 ml of 1.75% (w/v) barium chloride dehydrate with 99.5 ml 1% (v/v) sulphuric acid. This turbidity was equivalent to approximately  $1-2 \times 10^8$

colony-forming units per milliliter (cfu/ml), the suspension was then used for further testing (Arya *et al.*, 2010).

### Antibacterial bioassay:

Antibacterial bioassay was carried out following Disc Diffusion Method according to Arya *et al.*, (2010). The concentration of each extract per disc 12.5, 25 and 50 mg/disc in case of both upper and lower parts of corn silk and positive controls (synthetic drugs; Cefotaxime, Cephadrine and "Amoxycilin, Flucloxacilin"). Negative controls were ethanol, water and empty discs. The diameter of inhibition zone (measured in mm) is indicated by clear area in the Petri dish which was devoid of bacterial cells growth was measured. Each Petri dish contains four centered disks, r value of each disk = 5 mm, one layer, Whatman number 1 filter paper.

### Determination of activity and proportion indexes:

Calculations were carried out following the methods of Singh *et al.*, (2002) and Borgio *et al.*, 2008.

### Assay for total phenolics:

Total phenolics were estimated following the method of Gursoy *et al.*, (2009) involving Folin-Ciocalteu reagent and Gallic acid as standard. 1 ml of each extract of upper and lower parts of corn silk contains 100 mg F.W.. Concentrations of phenolic compounds were calculated according to the following equation that was obtained from the standard Gallic acid graph.

$$\text{Absorbance} = 0.0167 \text{ Gallic acid } (\mu\text{g}) + 0.017 \text{ (R}^2\text{: 0.99)}$$

### Assay for total anthraquinones:

Total anthraquinones were estimated using the method of Sakul Panich and Gristanapan, (2008). 1 ml of each extract of upper and lower parts of corn silk contains 100 mg F.W., using Emodin as standard.

### Assay for total flavonoids:

Total flavonoids were determined using the method of Gursoy *et al.*, (2009). 1 ml of each extract of upper and lower parts of corn silk contains 100 mg F.W.. Concentrations of flavonoid contents were calculated according to the following equation that was obtained from the standard Quercetin graph:

$$\text{Absorbance} = 0.0228 \text{ Quercetin } (\mu\text{g}) - 0.0045 \text{ (R}^2\text{: 0.9979)}$$

### Statistical analysis:

Statistical analysis of all results was done using Fisher analysis of variance methodology.

A least significant difference test was applied at 5% and 1% probability level to determine differences

among treatment means (Steel and Torrie, 1984). The MSTAT computerized package program was subjected to the regular statistical analysis of variance (Nissen *et al.*, 1985). Each reading = mean of three replicates  $\pm$  SD.

### Results and Discussion:

Results of antioxidant activity and DPPH scavenging activity (Table: 1) of upper and lower

parts of corn silk revealed that, there were non significant variations between upper and lower parts

of corn silk. It was found that upper parts were found to have the highest total antioxidant capacity and DPPH scavenging activity ( $2.735 \pm 1.180$  mg/g GAE<sub>s</sub>, IC<sub>50</sub> =  $0.704 \pm 0.067$  respectively).

**Table (1): Antioxidant activity of upper and lower parts of corn silk (Total antioxidant activity and DPPH scavenging activity methods).**

Corn silk	Total antioxidant activity (mg/g GAE <sub>s</sub> )	DPPH scavenging activity (IC <sub>50</sub> in mg/ ml)
Upper parts	$2.735 \pm 1.180$	$0.704 \pm 0.067$
Lower part	$2.150 \pm 1.180$	$1.001 \pm 0.067$
		<b>Quercetin (positive control) = <math>0.801 \pm 0.260</math></b>
L.S.D.(0.05)	3.947	0.263
L.S.D.(0.01)	5.839	0.436

Antibacterial activity studies of upper and lower parts of corn silk revealed that, using 12.5, 25 and 50 mg ethanolic extract/disc, both of them have no antibacterial activities against bacterial species under investigation "*Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) and *Klebsiella pneumoniae* (ATCC 700603), *Streptococcus pneumoniae* (ATCC 49619), *Staphylococcus aureus* (ATCC 25923) and *Streptococcus pyogenes* (ATCC 19615).

Concerning total phenolics, total anthraquinones and total flavonoids (Figure : 1), it was found that, upper parts of corn silk contain more amounts of these phytochemicals ( $180 \mu\text{g GAE/g F.W.}$ ,  $17.22 \mu\text{g/g F.W.}$  and  $119.47 \mu\text{g/g F.W.}$  respectively) than lower parts ( $151.33 \mu\text{g GAE/g F.W.}$ ,  $8.61 \mu\text{g/g F.W.}$  and  $101.66 \mu\text{g/g F.W.}$  respectively).

These results match morphological differences "in color" between upper darker parts and lower lighter parts of corn silk, according to Stapleton and Walbot, (2009) flavonoids and other phenolics can protect maize DNA from the induction of ultraviolet radiation damage, since upper parts of corn silk were exposed to sun more than lower parts, so accumulation of phenolics, anthraquinones and flavonoids in upper parts of corn silk more than their correspondings in lower parts can be considered as a defensive mechanism in the plant.



Figure:1. Total phenolics, anthraquinones and flavonoids in upper and lower parts of corn silk.

1- Total phenolics      2- Total anthraquinones      3- Total flavonoids

These results agreed with Ebrahimzadeh *et al.*, 2008 who found that, phenolics and flavonoids found in corn silk were thought to give maize silk its antioxidant properties.

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## The Egyptian Nursing Student's Perceptive view about an Objective Structured Clinical Examination (OSCE)

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**Abstract:** The aim of this study was to assess the third year nursing student's perception about an OSCE in Obstetrics and Gynecological Nursing. A descriptive design was utilized for collecting the data that are necessary to answer the research question. The sample consisted of 100 students who finished the 3<sup>rd</sup> year clinical teaching course of Obstetrics and Gynecological Nursing and were evaluated by an OSCE. The results of this study explored that more than one third of the students considered the announcement of the date and the place of examination were very good (39% and 38%, respectively). As regards the format of OSCE, the study identified that 41% of the students considered the revision done before examination was excellent. The majority of the students considered the quality of examination was excellent. Concerning the difficulties in time management during OSCE, more than half of the students (55%) were agreed. As regards the presence of emotional stress, more than two thirds of the students (77%) were agreed. In the light of the present study findings, it can be concluded that there is more need for careful preparation and organization of OSCE. The majority of the students appreciate the format of OSCE. The study has also highlighted that there are more need for training the students on time management and relieving their emotional stress during implementation of OSCE. It is essential to consider the recommended use of OSCE prescribed within wider context in nursing curriculum evaluation models. A larger study is needed to establish the effectiveness of OSCE within nursing education programs. An exploration of how successfully students transfer into clinical practice and to explore the validity and reliability of OSCE.

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**Key words:** OSCE, Validity, Reliability, Competence, ILOs

### 1. Introduction:

Without Doubt, clinical practice is one of the crucial components in nursing education, and it can be stressful for students. They may face many challenges or threats in dynamic and complex clinical environments, such as how to use high-tech medical equipment, how to maintain good relationships with clinical staff and instructors, how to manage sudden changes in a patient's condition, and how to deal with the demands of patients' relatives [1].

There is a widespread agreement that clinical learning has a central importance in nursing education. Although a theoretical and research-based education is vital for contemporary nursing on its own, it is not enough. Effective clinical placements are essential to becoming a competent professional nurse. Learning in the clinical environment provides the real world context for nursing students to develop the knowledge, skills, attitudes and values of a registered nurse [2].

Assessment of student nurses' clinical competence has been an integral part of the overall assessment strategy since formal nursing assessment began [3].

Enabling practical skills development is a key dimension of nurse education. This challenges nurse

educators to ensure that the integration of theory and practice occurs within both the practice and academic settings. Objective structured clinical skills evaluation (OSCE) is one of the approaches that have been used to meet these challenges. This approach has not been widely utilized in nurse education [4].

The OSCE emerged as an assessment strategy for medical education in Scotland during the 1970s. It is an assessment approach to students' clinical skills that is objective rather than subjective. The clinical competence is divided into various components such as history taking, or the interpretation of clinical data (such as nursing diagnosis) with each component being assessed at a different station [5].

The objective structured clinical examination (OSCE) has been in use in the assessment of medical students for over 20 years. In the last 10 years there has been increasing interest in this form of assessment in other health professional disciplines, such as nursing and physiotherapy [3].

Objective measurement of clinical competency has been a challenge for nursing educators and other professionals. The Objective Structured Clinical Examination (OSCE), first described in 1975, has been in used extensively in medical schools and residency programs in the United States. It is a valid



and reliable method of assessing clinical competence objectively in a variety of settings [6].

An OSCE requires each student to demonstrate specific skills and behaviors in a simulated work environment with standardized patients. It typically consists of a circuit or series of short assessment tasks (stations), each of which is assessed by examiner using a predetermined objective marking scheme [7, 8, 9].

In Australia, Bujack and Little, [10], documented the usefulness of OSCE in the nursing curriculum as enabling students to, "Integrate a range of knowledge and skills and to demonstrate the use of these in planning, implementing and evaluating care given in response to a single patient encounter" [8].

The advanced nursing Objective Structured Clinical Examination (OSCE) is a structured assessment of specific clearly defined clinical skills. In this examination, the students complete a set of individual OSCE stations (individual OSCEs are normally called stations) that are designed to test a range of clinical skills used in patient consultations, with an examiner using a previously determined, objective scoring scheme [11].

During an OSCE the clinical competence to be tested is broken down into its various components. For example, the acquisition of clinical data (history taking, physical assessment), the interpretation of clinical data (problem identification, nurse diagnosis), or the use of clinical data (decision making) supportive, educative, or therapeutic interventions [3].

The OSCE provided a learning opportunity for the nursing students, lecturers, and the institution. First the students stated that the experience of doing the OSCE gave them a sense of achievement. Lecturers involved in the administration of the OSCE felt that the planning had contributed to a good learning experience for the students. [3]

There are few researches study the student's Perception about this type of clinical examination, so the investigator will report and evaluate the Nursing Student's Perception about an OSCE to highlight the difficulties that may face them during the examination.

#### Aim of the study:

The aim of the study was to assess the third year nursing Student's Perception about the Objective Structured Clinical Examination (OSCE) in Obstetrics and Gynecological Nursing.

#### Research questions:

1. What are the perceptive views of the nursing students about the organization, format and quality of OSCE?

2. What are the advantages, disadvantages and the clinical skills gained from OSCE?

## 2. Subjects and Methods:

### Research design:

A descriptive analytic research was used in carrying out this study.

### Subjects:

### Setting:

This study was carried out in the Faculty of Nursing, Assiut University, Egypt.

### Sample:

The sample consisted of 100 female nursing students who finished the 3<sup>rd</sup> year clinical teaching course of Obstetrics & Gynecological Nursing and were evaluated by the Objective Structured Clinical Examination (OSCE).

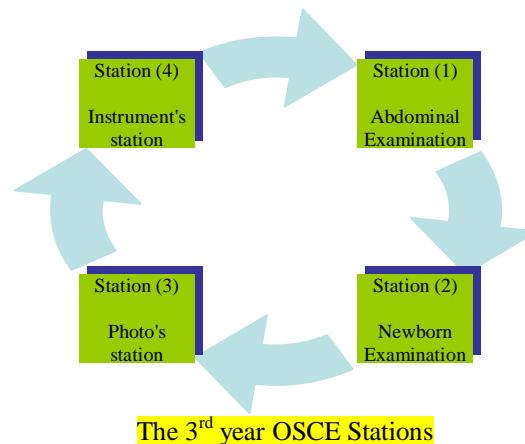
### Course Structure:

At the 3<sup>rd</sup> year, the students studied the clinical teaching course of the Obstetrics and Gynecological Nursing.

It included both the basic clinical skills and the clinical skills related to the specialty. The students were divided into four groups to practice and train the different skills such as: history taking, physical examination, communication skills and others.

### OSCE Design:

The OSCE consisted of four stations included the following: Two stations with simulated patients for the assessment of the abdominal and newborn examination. The 3<sup>rd</sup> station was photo's station to recognize the different photos related to the clinical course. The last station was instrument's station to recognize the name and function of the gynecological instruments.



**Analysis of the OSCE results:**

The teaching year	The teaching course	Pass (%)	Fail (%)
The 3 <sup>rd</sup> year	The Obstetrics and Gynecological Nursing Course	100%	0%

**Tool:**

After finishing the Obstetrics & Gynecological Nursing clinical teaching course, the student's perceptions about OSCE in Obstetrics & Gynecological Nursing were evaluated by a structured questionnaire designed by the investigator. The questionnaire was filled by those students. It included the following data:

- 1. Sociodemographic data** such as: name, age, and residence.
- 2. Data related to the organization of the OSCE measured** by scoring scale ranging from poor (1) to Excellent (5) such as:

(The announcement of the date and place of examination, the quality of the place of the examination, the cooperation of the staff to answer the student's questions about the examination, the orientation about the format of examination, and the revision done before the examination).

**3. Data related to the quality of the OSCE:**

The correlation between the OSCE and the ILOs (Intended Learning Outcomes) of the clinical curriculum, the correlation between the OSCE and the studied clinical curriculum, the correlation between the station's number and the studied clinical curriculum, the presence of difficulties in time management, the presence of the emotional distress and the quality of equipment and manikins used in examination).

- 4. Data related to the advantages, the disadvantages** of the OSCE, the main skills gained from OSCE and the most preferable OSCE station from the point of view of students.

**Methods:**

Before implementation of the study, an official permission was obtained from the Dean of the Faculty of Nursing, Assiut University, Egypt after full explanation of the aim of the study and its

reflection on developing the clinical teaching methods at the faculty. The pilot study was carried out before implementation of the study to test the validity and reliability of the questionnaire. The necessary modifications were done based on the results of the pilot study. The data were collected over two months, October and November 2010. After finishing the teaching semester and the OSCE of Obstetrics and Gynecological Nursing Curriculum, the investigator gave each student a questionnaire to be filled. The questionnaire included data about: their sociodemographic characteristics, the organization of the OSCE, the quality of the OSCE, the advantages, the disadvantages of the OSCE and the main skills gained from OSCE from the point of view of the students. Each student was interviewed individually by the researcher at her class. The number interviewed per day was 4-5 students. The average time taken for filling each questionnaire was around 10-15 minutes depending on the response of the student. Each student was reassured that the information obtained will be confidential and used only for the purpose of the study.

**Statistical analysis:**

Statistical analysis was done by using SPSS version 16 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for categorical variables and means and standard deviation for quantitative variables.

**Ethical considerations:**

- There were no risks can affect the students during the application of the study.
- Informed consent was obtained from the students before their participation on the study.

**3. Results:**

Table (1) shows that the mean age of the nursing students were  $20.92 \pm 0.69$  years. As regards residence, about two thirds of the students (65%) were living in rural areas.

**Table (1): Distribution of the Nursing students according to their Sociodemographic Characteristics:**

Sociodemographic Characteristics	Frequency (n=100)	Percentage (%)
Age (Mean $\pm$ SD)	20.92 $\pm$ 0.694	
Residence		
Urban	35	35%
Rural	65	65%
Total	100	100%

Table (2) describes the nursing student's perception about the organization of OSCE. More than one third of the students considered the announcement of the date and the place of the examination was very good. (39% and 38%

respectively). While nearly half of the students considered the quality of the place of examination and the cooperation of the staff was excellent (40% and 49%, respectively).

**Table (2): Distribution of the Nursing students according to their perception about the organization of OSCE:**

<b>The Student's Perception about the organization of OSCE</b>	<b>Frequency (n=100)</b>	<b>Percentage (%)</b>
<b>1. The early announcement about the date of examination:</b>		
Poor	5	5%
Good	35	35%
Very good	39	39%
Excellent	21	21%
Total	100	100%
<b>2. The announcement about the place of examination:</b>		
Poor	2	2%
Good	28	28%
Very good	38	38%
Excellent	32	32%
Total	100	100%
<b>3. The quality of the place of examination from lightening, quietness and ventilation:</b>		
Poor	1	1%
Good	22	22%
Very good	37	37%
Excellent	40	40%
Total	100	100%
<b>4. The cooperation of the staff to answer your questions related to the organization of the examination:</b>		
Poor	5	5%
Good	19	19%
Very good	27	27%
Excellent	49	49%
Total	100	100%

Concerning the student's perception about the format of OSCE. (Table 3) identifies that more than one third of the students (39%) considered the orientation about the format of the examination was excellent, while more than two thirds of the students (41%) considered the revision done before examination was excellent.

Table (4) shows the student's perception about the quality of OSCE. Concerning the correlation of the OSCE stations with the Intended Learning Outcomes (ILOs) and the clinical curriculum, the highest percentage of the students were agreed (92% and 96%, respectively). Regarding to the suitability of the number of the OSCE stations to the studied curriculum, the majority of the students (94%) were agreed. Concerning the difficulty in time

management during the OSCE, more than half of the students (55%) were agreed. As regards the presence of emotional stress and the presence of enough equipments and manikins for OSCE, more than two thirds of the students were agreed (77% and 79%, respectively).

Concerning the advantages of OSCE, figure (1) shows that more than half of the nursing students (58%) select broader range of skills tested, while only (20%) selects the presence of wide range of examiners to reduce the risk of bias.

Concerning the disadvantages of OSCE, figure (2) shows that nearly two thirds of the students (53%) considered OSCE needed careful planning.

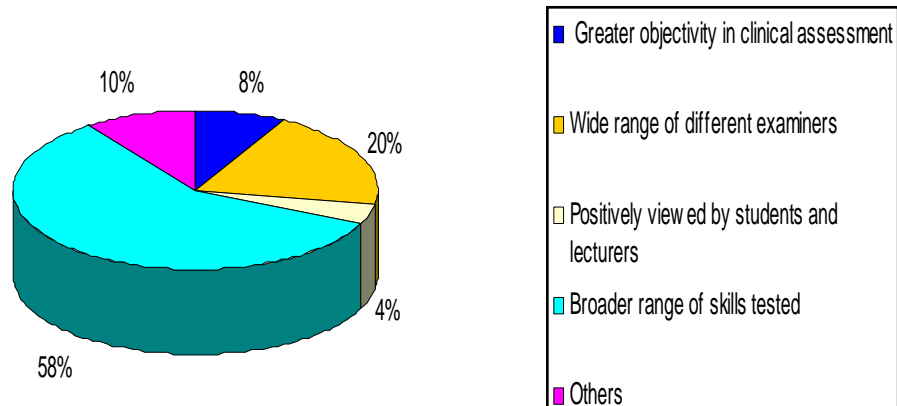
**Table (3): Distribution of the Nursing students according to their perception about the format of OSCE:**

The Student's Perception about the format of OSCE	Frequency (n=100)	Percentage (%)
<b>1. The orientation about the format of the examination:</b>		
Poor	4	4%
Good	22	22%
Very good	35	35%
Excellent	39	39%
Total	100	100%
<b>a. The duration of each station:</b>		
Poor	10	10%
Good	32	32%
Very good	33	33%
Excellent	25	25%
Total	100	100%
<b>b. The number of the OSCE station:</b>		
Poor	4	4%
Good	18	18%
Very good	42	42%
Excellent	36	36%
Total	100	100%
<b>2. The revision done before the examination about the different types of clinical procedure:</b>		
Poor	3	3%
Good	23	23%
Very good	33	33%
Excellent	41	41%
Total	100	100%

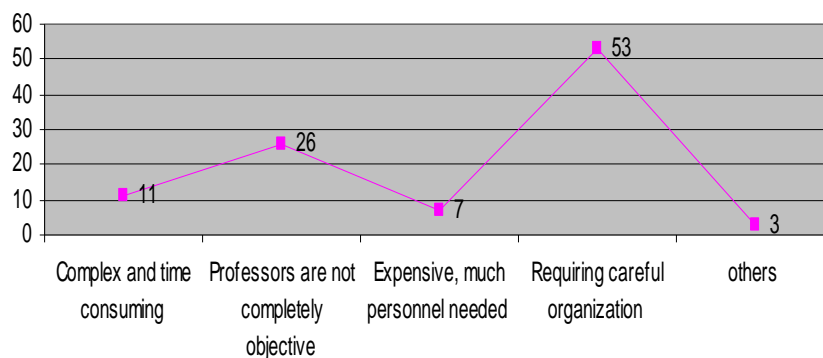
**Table (4): Distribution of the Nursing students according to their perception about the quality of OSCE:**

The Student's Perception about the quality of OSCE	Frequency (n=100)	Percentage (%)
<b>1. Did the stations of OSCE were correlated with the ILOs of the clinical curriculum?</b>		
Yes	92	92 %
No	8	8 %
Total	100	100%
<b>2. Did the stations of OSCE were correlated with the studied clinical curriculum?</b>		
Yes	96	96%
No	4	4%
Total	100	100%
<b>3. Did the number of the stations were enough in relation to the studied curriculum?</b>		
Yes	94	94%
No	6	6%
Total	100	100%
<b>4. Is there difficulty in time management during implementing the OSCE?</b>		
Yes	55	55%
No	45	45%
Total	100	100%
<b>5. Is there an emotional stress during examination?</b>		
Yes	77	77%
No	23	23%
Total	100	100%
<b>6. Are there equipments and manikins enough and had good quality?</b>		
Yes	78	78%
No	22	22%
Total	100	100%

**Figure (1) Distribution of the nursing students according to their perception about the advantages of OSCE**



**Figure (2): Distribution of the nursing students according to their perception about the disadvantages of OSCE**



**Table (5): Distribution of the Nursing students according to their perception about the skills gained from OSCE:**

The student's perception about the skills gained from OSCE:	Frequency (n=100)	Percentage (%)
a. Patient's taking history.	10	10 %
b. Counseling and health education.	13	13 %
c. Problem Solving.	9	9 %
d. The physical examination	60	60%
e. The translation of the electronic fetal heart traces.	3	3 %
f. The interpretation of the results of investigation.	5	5 %
Total	100	100 %



**Table (6): Distribution of the Nursing students according to their perception about the most preferable OSCE station:**

The student's perception about the most preferable OSCE station:	Frequency (n=100)	Percentage (%)
a. Physical examination station.	24	24 %
b. Gynecological instrument's station.	63	63 %
c. Photo's station.	13	13 %
Total	100	100 %

Table (5) shows the student's perception about the skills gained from OSCE. More than half of the students (60%) considered the physical examination skills is the most skill gained from OSCE.

Table (6) shows the nursing student's perception about the most preferable OSCE station. Nearly two thirds of the students (63%) considered the Gynecological instrument's station is the most preferable OSCE station.

#### 4. Discussion:

Assessment is central to any programme of education but is particularly relevant to nursing in order to ensure those who become registered nurses are safe and competent practitioners [12].

Objective structured clinical examinations (OSCEs) are an effective assessment strategy for assessing clinical skills [13] and for highlighting curriculum problem areas [8]. Their popularity has increased among nurse educators over the last decade [3].

OSCEs are now used within schools of Nursing and Midwifery as they can potentially assess both the theoretical and practical aspects of student's competence and can be more objective than assessment conducted in clinical practice [4; 14; 15].

The aim of the present study was to assess the perceptive view of the Egyptian nurse students in order to evaluate the process of OSCE. The questions of how was the clinical experience perceived by the students about the organization, format and the quality of OSCE process, and what were the advantages, disadvantages and the clinical skills gained from OSCE.

The results indicated that nearly half of the students considered the organization of OSCE is very good which is inconsistent with Troncon [16] who mentioned that nearly half of the students (48%) criticized the organizational aspects of OSCE.

Moreover, Furlong, *et al* [5] reported that in relation to the preparation of OSCE, the most of the students agreed that they were sufficiently prepared for the format and the content of the examination (87% and 82.7%, respectively).

Concerning the emotional stress initiated by OSCE, more than two thirds of the students (77%)

perceived this method of assessment as stressful which is similar to the research work reported by Brosnan [4] who mentioned that more than half of the students (52.7%) agreed that OSCE was more stressful than a written formal examination.

These findings are also consistent with Major [8] who clarified that the students still graded this method of assessment as stressful.

Meanwhile, Furlong, *et al*. [5] reported that the majority of the students (90%) of the nurse students in his survey perceived OSCE as a stressful method and they agreed that there were sufficiently prepared for the format and content of examination.

On the other hand, Marshall and Jones [17] reported that OSCE as a stressful method than other methods of assessment is not clearly defined because OSCE is not well established in nursing education.

The present study revealed also that more than half of the students (55%) had difficulties in time management during implementation of OSCE.

This finding is in agreement with Troncon [16] who reported that more than two thirds of the students (70%) considered OSCE process is difficult in time management and attributed higher grades to the degree of emotional stress elicited by the examination.

The difficulties on the part of the students in managing time during OSCE stations might be related to different factors including student's immaturity and lack of training in time management [16].

According to the present study, the success rate of OSCE was 100% which is inconsistent with Brosnan [4] who clarified that the success rate of OSCE was 95%.

On the other hand, Troncon [16] reported that the success rate of OSCE was 92%.

Concerning the advantages of OSCE, the present study findings revealed that the broader range of skills tested is the highest proportion of the advantages of OSCE (58%).

Mitchell, *et al*. [18] considered measuring an integration of skills is the main advantages of OSCE which is consistent with the present study.

Meanwhile, Major [8] reported that the main advantage of OSCE is putting the students in a real situation.

Buckingham [19] reported that the main advantage of OSCE is providing greater objectivity for assessment particularly for junior student.

Concerning the disadvantages of OSCE, the present study indicated requiring careful planning as the highest proportion (53%).

While OSCEs are an effective method of assessing clinical competence [20], they are costly to execute in terms of manpower, resources and time elements and require careful planning to be successful which is similar to the present study. [13]

The present results indicated important information about the student's perceptive views about the organization and format of OSCE. The key learning points that arose from this research related to the benefits of interviewing students after finishing their OSCE. The interview provided a useful opportunity for providing feedback for the students and listening to their perceptions about OSCE process.

## 5. Conclusions:

Objective structured clinical examination can be a part of an effective assessment strategy of nursing clinical education in Obstetrics and Gynecological Nursing branch and provide a positive learning experience. This paper discusses Obstetrics and Gynecological nursing student's perceptive views about an OSCE in relation to organization, format and the quality of examination. It is interesting to note that there is more need for careful preparation and organization of OSCE. In the light of the present study findings, it can be concluded that the majority of the students appreciate the format of OSCE. The study has also highlighted that there are more need for training the students on time management and relieving their emotional stress during implementation of OSCE. The students noted that the main benefit of OSCE is testing a broader range of skills and the main disadvantage is its need for careful planning and organization. It is interesting to note that the students considered the physical examination is the most skill gained from OSCE.

## Recommendations:

It is essential to consider the recommended use of OSCE prescribed within wider context in nursing curriculum evaluation models. The study has identified many areas for further exploration. A larger study is needed to establish the effectiveness of OSCE with in nurse education programs. An exploration of how successfully students transfer into clinical practice and to explore the validity and reliability of OSCE. More research is required involving larger number of students from different faculties of nursing.

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## Impact of Sirolimus Versus Cyclosporin A Immunosuppressive Drug in Dog's Alveolar Bone

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**Abstract:** Sirolimus is a modern immunosuppressive drug that has a novel mechanism of action as it improves the patients' condition receiving transplant. This study aimed to assess the effects of sirolimus Vs cyclosporin A (CsA) immunosuppressive drug on teeth's alveolar bone. Fifteen Mongrel dogs were used in this study. They were classified into three equal groups. The 1st group is considered as control. The 2nd and 3rd groups were subjected to cyclosporin A and sirolimus treatment protocol, respectively up to 45 days. The parameters involved were 1) body weight (BW), 2) biochemical markers of serum osteocalcin (OC) and alkaline phosphatase (APH) levels. 3) Densitometric analysis for the mandibular alveolar bone at canine area using dual energy X-ray absorptiometry. 4) All animals were euthanized, mandibles were dissected and specimens taken from the canine areas (canine and its supporting bone) and specimens were processed to examine the alveolar bone changes at the end of the experiment and 5) histomorphometric analysis using Masson's trichrome stain evaluated the width of periodontal ligament. Results obtained revealed a significant decrease of both body weight and alveolar bone mineral density. Meanwhile, there were significant increases of periodontal ligament width, serum OC and APH. We concluded that both sirolimus and CsA drugs have adverse effects on the alveolar bone quality. Also, the sirolimus produced the worst effects regarding BW, BMD of teeth's alveolar bone, serum OC and APH levels with evidence of osteoporosis.

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**Key words:** Alveolar bone; Osteoporosis; Bone mineral density; Sirolimus; Cyclosporin A.

### 1. Introduction

The chronic post-renal transplantation complication subsequent to the long-term immunosuppressant treatment is bone loss associated with osteoporosis [Campistol et al., 2005]. Osteoporosis is a clinically important problem affecting from 6 to 15% of all patients in the first year after transplantation [Shane and Epstein 2001] with incidence of spontaneous osteoporotic fractures as high as 25%-65% due to reduced bone quality [Patel et al., 2001] and avascular bone necrosis [Hamdy et al., 2005]. The organ transplantation rejection has been dramatically reduced and the survival rate of transplanted patients has been improved by using modern immunosuppressant such as sirolimus (Rapamune) [Casas-Melley et al., 2004]. Rapamune; (C<sub>51</sub>H<sub>79</sub>NO<sub>13</sub>, molecular weight 914.2) is a naturally occurring water-insoluble macrolide antibiotic produced by the *Streptomyces hygroscopicus* bacterium, which was serendipitously isolated by Dr. Suren Sehgal from soil samples taken from the Vai Atare region of Easter Island [Sehgal 2003]. It was approved by the United States FDA in 1999, as an immunosuppressant to prevent allograft rejection in several phase 2 and phase 3 clinical trials

either in combination with cyclosporin A (CsA) or used as a primary therapy [Johnson et al., 2001].

Other immunosuppressive drugs commonly used in transplantation, such as CsA and tacrolimus (FK506), have also been shown to have a deleterious effect on bone mineral metabolism in the rat [Schlosberg et al., 1989]. Unlike CsA or tacrolimus, sirolimus drug is structurally related to tacrolimus but functions through a different pathway; it has no effect on calcineurin phosphatase avoiding the long-term calcineurin inhibitor side effects. These side effects include reduced glomerular filtration rate, nephrotoxicity, hypertension and diabetes mellitus therefore conferring a different safety profile [Campistol et al., 2005].

The sirolimus mechanism of action is different, where it blocks T-cell proliferation at a later stage than calcineurin inhibitors by affecting interleukin (IL)-2- and IL-4 induced signal transduction pathways rather than having a direct effect on cytokine production [Luo et al., 1993]. The inhibition of T-lymphocyte activation and proliferation that occurs in response to antigenic and cytokine lead to inhibits antibody production [Saunders et al., 2001]. In the cells, the macrocyclic immunomodulatory drug that are bioactive only when complexes with

ubiquitous intracellular binding proteins immunophilins and a specific effectors' protein to generate an immunosuppressive complex, immunophilin FK506-binding protein (FKBP)12; this complex binds to and inhibits the activation of the mammalian target of rapamune (mTOR) which inhibiting the progression from the G1 to the S phase of the cell cycle [Tsang et al., 2007]. mTOR is a 289 kDa phosphatidylinositol 3-kinase-related kinase which is evolutionarily conserved from yeast to mammals. It has a critical role in promoting cellular growth and differentiation, cell cycle progression, apoptosis and organ size [Carlson et al., 1993].

Moreover, sirolimus has a beneficial effect as it prevents the onset or ameliorates the evolution of various experimental autoimmune diseases, such as murine systemic lupus erythematosus, type I diabetes mellitus, collagen-induced arthritis, or adjuvant arthritis, experimental autoimmune uveoretinitis and experimental allergic encephalomyelitis in the rat. The most notable side effects of sirolimus were hyperlipidemia (both hypercholesterolemia and hypertriglyceridemia) and thrombocytopenia and leukopenia, which may lower the lifespan of the transplanted patients [Deters et al., 2001]

There is a doubt whether the sirolimus had no effect on bone metabolism of supporting teeth structures while the concern has been raised over the unique structure of alveolar bone supporting teeth in patients received tissue transplant as it expressed extensive macroscopic and microscopic changes during occlusion and mastication. So; this study intended to assess the effect of sirolimus on alveolar bone and periodontal ligament supporting teeth structures versus different conventional immunosuppressant like CsA.

## 2. Materials and methods:

All experimental protocols involving animals conformed to procedures described in the Guiding Principles for the Use of Laboratory Animals according to the ethical committee for animal care (Laboratory Animal Center, Mansoura University, Egypt). The experimental study was conducted for 45 days. Fifteen adult healthy males, Mongrel dogs, aged between 8 and 10 months of age pathogenic free were selected for the present experimental work. Each dog was subjected to the same conditions through caging individually with proper light and temperature and feeding soft food under controlled conditions of humidity ( $50 \pm 10\%$ ), light (12-h light/dark cycle), and temperature ( $23 \pm 2^\circ \text{C}$ ). The dogs were divided into three equal groups of five dogs. In 1st group, the dogs did not receive any medication and were considered as a control. The animals of 2nd group; received CsA (Sandimmune,

Novartis, E. Hannover, NJ, USA) which were given in a dose of 15 mg/kg/twice daily. Serum samples (taken after 1 week of start) for the determination of trough CsA levels were taken and stored at  $-20^\circ \text{C}$ . CsA assay was performed using a monoclonal fluorescence polarization immunoassay (Abbott Laboratories, Abbott Park, IL USA). Trough levels were adjusted at the therapeutic range of 200–300 ng/ml. While the dogs of 3rd group received sirolimus (Rapamune, Wyeth, 5 Giralda Farms and Madison, NJ, USA), 1 mg/kg/day [Sorrer et al., 2008].

## Body weight, biochemical markers and bone densitometry:

At end of experiment, the animals' body weights (BW) were recorded in each group. The biochemical markers were evaluated for serum osteocalcin radioimmunoassay and serum quantitative assay for alkaline phosphatase as the animals were referred to veterinary surgeons for obtaining the blood samples under sterile conditions via marginal vein of ear. Serum osteocalcin (OC) samples were measured by a previously described technique [Delmas et al., 1993]. While the serum concentrations of alkaline phosphatase (APH) was determined by the DGKC method (Biozyme Laboratories Ltd., South Wales UK) and measured with a KEM-O-MAT 2 (Coulter Electronics Ltd, Florida, USA). The bone densitometry scans of the alveolar bone in canine area of the mandible were performed by using dual energy X-ray absorptiometry; (DEXA) (DXL, Calscan, Demetech AB, Stockholm, Sweden) to measure the bone mineral density in  $\text{mg}/\text{cm}^2$  with software for animals (Hologic, INC, Waltham, USA).

## Histological and histomorphometric examination

At the end of experiment; each animal was sedated with an intramuscular injection of 1 mg/Kg Xylazine. General anesthesia was induced with an intramuscular injection of 6-mg/Kg Thiopentone. Before the beginning of all experimental procedures the trachea was intubated and general anesthesia was maintained using halothane (1.5–2.5%) in oxygen, delivered through a semi-closed breathing circuit. The mandibles of all groups were dissected and the specimens taken from the canine areas included the canine' tooth and its supporting bone from each side that were processed and prepared for Haematoxylin and Eosin staining to examine the alveolar bone and periodontal ligament tissue. In addition, the histomorphometric examination was performed to evaluate the width of the periodontal ligament by using Masson's trichrome stain. The measurements performed manually using a micrometer integrating eyepiece; the distances were analyzed including



sections within two fields at x250 magnification from cementum to alveolar bone trabeculae in different three point areas at cervical, middle and apical part by two different investigators.

**Statistical analysis:** The laboratory and biochemical parameters were analyzed with one way and two ways ANOVA using SPSS 17.0 for windows (SPSS Inc, Chicago, Illinois, USA). The data were analyzed for histomorphometric examination, biochemical markers like OC and APH levels, then the body weight of dogs and bone densitometry in mandibular canine area of alveolar bone in each group, the data were expressed as mean and SD and the  $P$  value  $<0.05$  was considered significant.

### 3. Results:

#### 1) Body weight:

The means of BW were significantly decreased in CsA group and in sirolimus one at  $P<0.05$  level Table(1).

#### 2) Biochemical marker:

A significant increase of OC and APH serum levels in sirolimus and CsA groups compared to control one. The mean values for OC and APH were significantly increased in sirolimus group in comparison with CsA one at  $P<0.05$  level [Table 1].

**Table1: BW, BMD, OC and APH for the different groups**

Group	BW (kg)	BMD (mg/cm <sup>2</sup> )	OC (ng/ml-1)	APH (U/l)
Control	8.87 <sup>a</sup> ± 0.77	669.2 <sup>a</sup> ± 71.54	46.71 <sup>a</sup> ± 1.29	12.28 <sup>a</sup> ± 0.48
CsA	6.27 <sup>b</sup> ± 0.54	453.2 <sup>b</sup> ± 26.54	52.82 <sup>b</sup> ± 2.54	15.46 <sup>b</sup> ± 1.24
Sirolimus	3.45 <sup>c</sup> ± 0.158	338 <sup>c</sup> ± 14.46	61.62 <sup>c</sup> ± 2.88	17.26 <sup>c</sup> ± 1.12
<i>F</i> Value	238.408	140.587	103.15	62.616
<i>P</i> value	0.05	0.05	0.05	0.05

Values with same superscripts are non significant

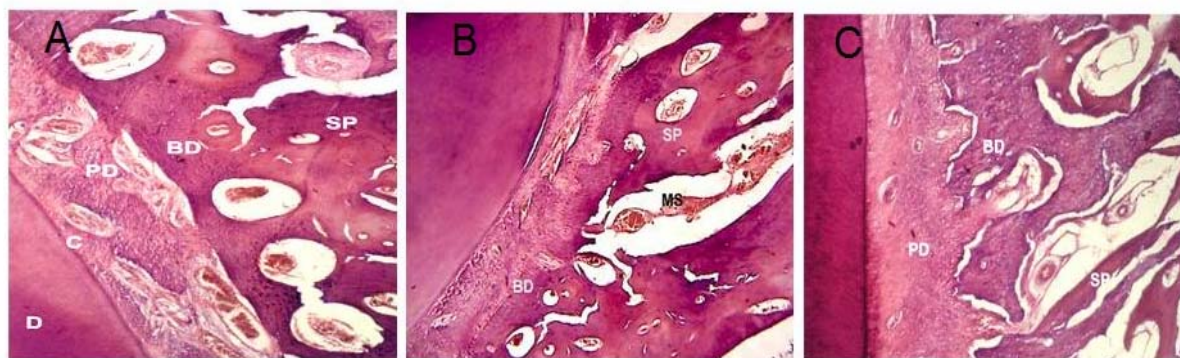
#### 3) Bone densitometry:

ANOVA test for the BMD means revealed that the mean differences were significant between two groups at  $P<0.05$  where the LSD multiple comparisons showed significant difference between each of two groups. The mean BMD was decreased in CsA group than in sirolimus one.

#### 4) Histological finding:

The histological sections of the control group (Fig 1A) at the middle part of canine dog's tooth showed normal architectures of dentine formation (D), cementum (C), periodontal ligament (PD), bundle bone (BD) and supporting lamellated bone (SP). The

CsA treated group (Fig 1B) sections showed multiple areas of bundle bone (BP) resorption with widened bone marrow spaces (MS) in a little area, the architecture of supporting alveolar bone (SP) seem to be normal. While the Sirolimus treated group section (Fig 1C) showed irregularly resorbed bundle bone (BP) with invasion of less vascular periodontal ligament (PD) in the resorption sites and marrow spaces. Loss of lamellated regular pattern of supporting alveolar bone (SP) and subsequent rarified osteones and bony trabeculae, with widened marrow spaces can be seen.



**Fig 1: photomicrograph at the middle part of canine dog's tooth of the control group (A), CsA treated group (B) and sirolimus treated group (C) (H&E x400).**

### 5) Histomorphometric result:

In the table [2]; there was a significant difference in thickness of periodontal ligament between the control Vs sirolimus and CsA group at level of  $P < 0.05$ . There was no significant difference between the thickness of periodontal ligament of sirolimus and cyclosporin groups.

**Table 2: Thickness of periodontal ligament at different locations for different groups.**

Group	Thickness	Location
	Mean $\pm$ SD	Mean $\pm$ SD
Control	0.44 <sup>a</sup> $\pm$ 0.10	0.96 <sup>a</sup> $\pm$ 0.85
CsA	0.59 <sup>b</sup> $\pm$ 0.10	1.00 <sup>a</sup> $\pm$ 0.83
Sirolimus	0.64 <sup>c</sup> $\pm$ 0.12	1.06 <sup>a</sup> $\pm$ 0.82
F value	31.507	0.111
P value	0.05	0.895

Values with same superscripts are non significant

### 4. Discussion:

Sirolimus has emerged as one of the most promising immunosuppressive agents when used alone or in combination. The use of sirolimus is attractive as primary prophylaxis for chronic graft against host prevention not seen with other classes of immunosuppressant due to its unique properties that can offer several advantages [Cutler and Antin 2010] as a new approach to overcome the problem of chronic calcineurin inhibitor nephrotoxicity without increasing the risk of allograft rejection.

The experimental models like animal, in vitro were performed to investigate the effect of any materials by using any measures, the results from animal models may transfer to humans [Krocker et al., 2006] in addition to the microscopic finding which give more convenient tool for histological finding. In the present study, we selected the dogs as animals that have the ability to withstand the long term immunosuppressant drugs to evaluate the adverse effect on bone composition through biochemical and histological examination.

The result of present study showed evidence of osteoporosis in CsA and sirolimus group in comparing to control one appeared as significant increases of biochemical bone marker for OC and APH serum levels associated with significant decreases of BW of the animal and BMD at canine areas of alveolar bone in addition to the histological finding represented as resorption of bundle bone layer even exposing the lamellated bone with widening of bone marrow and significant increases of periodontal ligament width. The sirolimus group result was the worst.

In relation to CsA, results were in agreement with Yeoa, et al., 2007; who reported that the

administration of CsA to rats at doses (15 mg/kg) showed significant bone resorption and trabecular bone loss, resulting in severe high turnover osteopenia and decrease trabecular bone volume. Consistent with the work by Arzate et al., 2005 that revealed an inhibition of osteoblast differentiation by CsA at high concentrations to mice and significant decreases of trabecular bone volume. Furthermore, non-cephalic whole body bone mineral density measured by DEXA was significantly decreased after treatment with high doses of CsA [Arzate et al., 2005 & Yeoa, et al., 2007].

Previous investigations about the effect of CsA on bone are in agreement with the current study that the histological observation showed increased bone remodeling with resorption exceeding formation in experimental animals. In contrast, the in vitro study revealed that CsA inhibits stimulated bone resorption and both osteoblast and osteoclast activity and inhibits the proliferation, number, mitogenesis, attachment and APH concentrations of osteoblasts [McCauley et al., 1992], but in vivo it apparently yielded increases bone turnover, increased bone formation with excessive resorption [Derfus et al., 1991]. There is evidence for both decreased bone formation and enhanced bone formation with excessive resorption could be attributed to differences in the particular bones investigated or in the microanatomy if the chosen animals were of different ages apparently contradictory patterns of bone turnover [Klein, 1981].

The result of APH and OC serum had significant increases in CsA group, this results were in agreement with the previous studies on humans and animals. In human renal transplant patients treated with CsA; it has greater serum concentrations of bone markers, APH and OC, which revealed an increased osteoblastic activity [Withold et al., 1994 & Bonnin et al., 1997]. These patients had firstly a decreased in serum APH that was noted one week after CsA administration; then; the enzyme returned to normal one month after administration and then increased significantly after 3-6 months Also; changes in the concentration of OC, showed a decreasing for a short time and then increasing, in renal transplant patients who received CsA [Bonnin et al., 1997]. Similarly, in the rat model, there was a tendency for APH to decrease 1-2 weeks after CsA administration and then return to normal at 4 weeks [McCauley et al., 1992].

The results of sirolimus treated group in present study showed significant decreases in BW that were in agreement with the study carried out by Sanchez and He, (2009) and their investigators; who reported that bone length decreased in young rats with normal

renal function treated with sirolimus at 2 mg/kg daily for 14 days accompanied by alterations in growth plate architecture; even it lowered the chondrocyte proliferation [Earl et al., 2001]; that in turn reflected on our opinion on body weight. The changes in trabecular bone modeling and remodeling with decrease in body length have been demonstrated in 10 week old rats after 2 weeks of rapamune and they attributed that due to the anti-proliferative effects rapamune therapy which may have adverse effects on linear growth in young children [ Sanchez and He, 2009].

This result was in contradiction with Joffe and coworkers (1993) as they revealed a transiently lowered serum OC levels without any affect on the trabecular bone volume or bone formation rate with higher dose of rapamycin at 2.5 mg/kg per day for 14 days, also; the in-vitro study demonstrated that the rapamune with high dose inhibits the osteoclast function, lessens bone resorption, decreases osteoblast proliferation and enhances osteoblast differentiation [Singha et al., 2008]. On the other hand; the in vivo study showed that the high doses of rapamune increase bone turnover reflected by the elevation of OC and non collagenous bone protein secreted by osteoblasts [Holstein et al., 2008]. Alvarez-Garcia et al., (2007) demonstrated that rapamune reduces chondrocyte proliferation and maturation during endochondral ossification in growth plates of young rats which was associated with a decreased resorption of cartilage and an alteration of vascular invasion, they attributed this effect to a decreased vascular endothelial growth factor expression in hypertrophic chondrocytes after rapamune treatment. Also, rapamune had tested in early fracture healing at 2nd week post fracture by Holstein et al., (2008) and found that the treatment leads to a severe alteration, as indicated by a decreased torsional stiffness. This effect was associated with a significant inhibition of hard callus formation together with a dramatically reduced formation of new woven bone.

**Conclusion:** Within the limitation of the current study; both sirolimus and CsA drugs have adverse effects on the alveolar bone quality. The sirolimus produced the worst effects regarding of BW, BMD of teeth's alveolar bone, serum OC and APH levels with evidence of osteoporosis that reflected histologically as resorption of bundle layer of alveolar bone and exposure of lamellated supporting bone with subsequent increases of periodontal ligament width.

**Recommendations:** More researches must be done to examine new therapy or dietary supplement given to the transplant recipient patient suffering from long term immunosuppressant therapy to minimize and

treat or at least to improve this complication and promote bone formation metabolism.

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**Conflicts of interest:** None.

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## Antibacterial Activity of Methanolic Extract of Dominant Marine Alga (*Padina pavonia*) of Tolmeta Coasts, Libya

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**Abstract:** This study mainly aimed to identify the marine algae of Tolmeta coasts and evaluate the antibacterial activity of the most dominant species (*Padina pavonia*) as compared with some famous antibiotics. During many sampling visits at 2009, Thirty four marine algal species (26 genera) were collected and identified at Tolmeta coasts (150 Km. eastern north Benghazi city). Two species (5.88%) of the collected algae (*Lyngbia* and *Rivularia*) were belonging to Cyanophyta, Six species (17.65%) belong to Chlorophyta, thirteen species (38.24%) belonging to Phaeophyta (with special reference to genera *Padina* and *Cystoseira*) and thirteen species (38.24%) belonging to Rhodophyta. The R/P ratio was 1.00 which indicated the rough weather of this area. *Padina pavonia* was the most dominant species at all samples, methanolic crude extract (at cold and 24 h.) were tested against *Escherichia coli* and *Staphylococcus aureus* bacteria and matched with some famous antibiotics. All of the treatments were affected *Escherichia coli*, they could statistically ranked dissentingly as Ci > E15 > Sxt at the first rank and Te30 > *Padina* extract at the second rank while P10 came at the third rank with significant values. Meanwhile, *Staphylococcus aureus* was affected only by E15 antibiotic.

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**Key words:** Marine algae, R/P ratio, *Padina pavonia*, *Escherichia coli* and *Staphylococcus aureus*.

### 1. Introduction:

Edible seaweeds contain a significant amount of the protein, vitamins and minerals essential for the human nutrition (Fayaz *et al.*, 2005). Most of the compounds of marine algae show antibacterial activities (Vairappan *et al.*, 2001), used as direct and indirect human food sources (Dawes, 1998 and Rajasulochana *et al.*, 2009), and used also in new pharmaceutical industries (Lima-Filho *et al.*: 2002: Ely *et al.*, 2004 and Tüney *et al.*, 2006) and recently showed antimicrobial activities (El-Gahmy, 2007, Venkateswarlu *et al.*, 2007, El-Fatemy, 2008, Ki-Bong Oh *et al.*, 2008 and Rajasulochana *et al.*, 2009). Said and Godeh, (2008) reported that Tolmeta coasts characterized by 32 marine algal species. Most of them could use as ecological quality indicators (Pinedo, *et al.*, 2007). *Padina* sps grow and dominated in the shore of Kanyakumari and Ramanthapuram Districts of Tamilnadu State, India giving significant effect when tested against *Escherichia coli* and *Staphylococcus aureus* bacteria (Rajasulochana *et al.*, 2009). Organic solvent always provides a higher efficiency in extracting compounds for antibacterial activities comparative water based methods (Tüney, *et al.*, 2006). El- Baghdadi (2000) evaluated that the extracts of *Dilophus spiralis* more effective more than those of *Padina pavonia* on some Bacterial species. El-Sal (2005) evaluated that some

algae of Musrata coasts could secrete antibacterial substances. Recently, El-Fatemy (2008), El-Fatemy *et al.*, (2009) and El-Fatemy & Said (2011) tested some Dictyotales algae from Benghazi and Gheminis coasts on some pathogenic and dermatophytes isolated from some clinical departments of child and El-Gamaheria hospitals. So, this study tries to evaluate the antibacterial activities of some Libyan marine algae.

### 2. Material and Methods

#### The Study area:

The geographical location of the study area is illustrated in Fig. 1. Tolmeta coast lies, about 150 Km. northern east Benghazi at 32° 41' 45.68" N and 20° 57' 38.99" E. Their open rocky shores had little sandy parts and some small rocky islands very closed to their beaches. They are also had very small fishing ports without any pollution and human beings activities.

#### Sampling and sample preparations:

Specimens were harvested generally in the morning in ice tanks at nylon or polyethylene bags sprinkled with 4% formalin sea water solution for mounting on the herbarium sheets, glass bottles and some of them kept freshly at refrigerators for future use and subsequent taxonomic identification using



Pampanini (1931), Burrows (1991) and Aleem (1993). Epiphytes, impurities and salts were removed carefully and quickly at laboratory with tap and distilled sterilized waters. Samples were kept under sunshade for 7 days till complete drying then ground to powder form and packaged in paper for extractions (Rao and Parekh, 1981 and Vlachos *et al.*, 1996). The herbarium sheets have been deposited in the Herbarium, Department of Botany, Garyounis University, Benghazi {CHUG nos. FM. 650; 651}. Longitudinal and transverse sections of the axis at the apexes, midfronds and the bases were hand made and stained in 1% KI<sub>2</sub> or Anilin blue solution.



**Fig. 1: Map of Libya and the study area (Tolmeta coast).**

### Species richness:

Species richness index calculated according to Wilhm, (1975) by direct count of different algal species (taxa) at every sampling site where, the decrease in number of species and increase in number of individuals is a characteristic feature of polluted water.

### Algal Extracts:

The crude algal active methanolic extractions obtained according to Crasta, *et al.*, (1997) by soaking 5g. of cleaned, washed, dried and grinded algal tissues in 100 ml. of methanol solvent 96% (Kaufman, *et al.*, 1999) by Soxhlet for 2 hours at 80 °C and concentrated at 2.5 ml. in dark at room temperature (25±3°C) according to Vlachos *et al.*, (1996). The crude methanolic extracts and some antibiotics were tested against the bacterial growth. The crude algal active extractions were tested to be easily for many people to introduce fresh algae in their food and pharmaceutical uses.

### Bacterial Growth conditions and antibacterial activities:

Under septic conditions, antibacterial activities were tested against the Bacteria (100 µm of

10<sup>8</sup> conc.) which isolated from Benghazi children hospital, sub-cultured and routinely maintained by three dimension streaking method on both Nutrient agar and Muller Hinton agar media according to Cheesbrough, (1984) for 18 - 24 hours at 37±2°C.

Hole-plate and disc diffusion methods used to evaluate the antibacterial activities of algal extract and some antibiotics, respectively (Bauer, *et al.*, 1996). Clear zones around holes were measured in millimeters (mm) carefully at least six replicate with crude algal extracts and different antibiotics. The extracting agent (methanol) was tested as control (Tüney *et al.*, 2006). Bacterial suspensions were kept at 4°C for further treatments. The stock cultures were maintained in sterilized soil (3 successive days) at 4°C and sub-cultured in agar slants whenever required. The standard disc diffusion method was used with five specific antibiotics.

### Statistical analysis:

The data were statistically analyzed using (SAS) Statistical Analysis System (1995) according to general linear models:

$$Y_{ij} = \mu + A_i + e_{ij}$$

Where:  $Y_{ij}$  = The  $j^{th}$  clear zone of  $i^{th}$  algal extract and antibiotics.

$\mu$  = Overall mean.

$A_i$  = Fixed effect of the  $i^{th}$  algal extract and antibiotics (1, 2, ..., 6).

$e_{ij}$  = Error assumed to be NID (0,  $\sigma^2_e$ ).

### 3. Results and Discussion

Tolmeta coasts were characterized by only 34 species and 26 genera of marine algae. Cyanophyta represented only 2 species (5.88%) and 2 genera (7.69%) of the recorded algae (Table 1). There are just 6 species (17.65%) and 6 genera (23.08%) belonging to Chlorophyta (Table 2), Phaeophyta (Table 3) represented by 13 species (38.24%) and 6 genera (23.08%) and Rhodophyta (Table 4) represented by 13 species (38.24%) and 12 genera (46.15%). At relatively similar area and conditions, Godeh *et al.*, (2008) reported that, Tobruk coasts characterized by thirty six species of different marine algae.

According to the species richness indication of Wilhm, (1975), one could conclude that, Tobruk coast is more or less pure and sustained than Tolmeta coast. Said *et al.*, (2005) used the species richness parameters carefully to evaluate the purity and pollution state of different four Egyptian water bodies. According to the finding of Diaz-vades *et al.*, (2007) and Pinedo, *et al.*, (2007) many of the identified marine algal taxa considered as indicators to the good and very good ecological quality waters

like *Cystoseira*, *Corallina*, *Hypnea*, *Jania* and *Laurencia*.

Contrarily, Rhodes Island was relatively richer where 155 macroalgal taxa (Tsiamis, *et al.*, 2007) had. Diaz-Valdes, *et al.*, (2007) identified 65 Littoral macroalgae using them to assess the environmental quality of Valencian rocky coasts (SE Spain). Diapoulis and Tsiamis (2007) also found 88

marine benthic macroalgal taxa at the upper infralittoral zone of South Aegean Sea (Greece).

Cyanophyta represented only 2 species (5.88%) and 2 genera (7.69%) of the recorded algae (Table 1), they were *Lyngbia* and *Rivularia*. Both of them were present as very small batches on the much closed rocky parts of the shores.

**Table (1): Distribution of Blue-green marine algae at Tolmeta coasts:**

<b>Cyanophyta</b>
<b><i>Lyngbia</i> C. Agardh ex Gomont 1895</b>
<i>Lyngbia sordida</i> (Zanardini) Gomont
<b><i>Rivularia</i> Bullata</b>
<i>Rivularia bullata</i> (Poiret) Berkeley
Number of genus = 2    Number of species = 2

**Table (2): Distribution of green marine algae at Tolmeta coasts:**

<b>Chlorophyta</b>
<b><i>Acetabularia</i> Lamouroux 1817</b>
<i>Acetabularia acetabulum</i> (Lamx.) Silva
<b><i>Anadyomene</i> Lamouroux 1812</b>
<i>Anadyomene stellata</i> (Wulf.) C. Agardh
<b><i>Caulerpa</i> Lamouroux 1809</b>
<i>Caulerpa prolifera</i> (Forsskål) Lamouroux
<b><i>Dasycladus</i> C. Agardh 1828</b>
<i>Dasycladus vermicularis</i> (Scopoli) Krasser
<b><i>Flabellia</i> Reichenbach (<i>Udtea</i> Lamouroux)</b>
<i>Flabellia petiolata</i> (Turva) Nizamuddin
<b><i>Halimeda</i> Lamouroux 1816</b>
<i>Halimeda tuna</i> (Ellis ét Solander) Lamouroux
Number of genus = 6    Number of species = 6

**Table (3): Distribution of brown marine algae at Tolmeta coasts:**

<b>Phaeophyta</b>
<b><i>Cystoseira</i> C. Agardh 1820</b>
<i>Cystoseira barbata</i> (Goodenough ét Woodward) J. Agardh
<i>Cystoseira cinitophylla</i> Ercegovic
<i>Cystoseira compressa</i> Gerloffi ét Nizamuddin
<i>Cystoseira elegans</i> Sauvageau ét Feldmann
<i>Cystoseira discors</i> (Linn.) C. Agardh emend. Sauvageau
<i>Cystoseira gerloffi</i> Nizamuddin
<i>Cystoseira stricta</i> (Montagne) Sauvageau
<b><i>Dictyopteris</i> Lamouroux 1809</b>
<i>Dictyopteris membranacea</i> (Skackhouse) Batters
<i>Dictyopteris tripolitana</i> Nizamuddin
<b><i>Dictyota</i> Lamouroux 1809</b>
<i>Dictyota dichotoma</i> (Hudson) lamouroux
<b><i>Padina</i> Adanson 1763</b>
<i>Padina pavonia</i> (Linnaeus) Lamouroux
<b><i>Sargassum</i> C. Agardh 1820</b>
<i>Sargassum hornscuchii</i> C. Agardh
<b><i>Scytosiphon</i> C. Agardh 1820</b>
<i>Scytosiphon lomentaria</i> (Lyngbye) Lamouroux
Number of genus = 6    Number of species = 13

Chlorophyta were represented by Just 6 species (17.65%), 6 genera (23.08%) of the total recorded algae (Table 2), The reduction of green species may be due to the presence of *Caulerpales* which considered strong competitors and its production of toxic substances, which inhibit their grazing (David *et al.*, 2004 and Piazzzi *et al.*, 2005).

Thirteen species (38.24%), six genera (23.08%) of them were belonging to Phaeophyta (Table 3) with special reference to genera *Padina* and *Cystoseira*. Contrarily, Mubina and Nausheba, (1992)

identified 48 brown species at Karachi coast in India. *Cystoseira* species could used as an additional important argument for securing a more wise and sustainable use of the coastal ecosystem that they indeed play a critical role in the conservation of species and habitat diversity (Turk, *et al.*, 2007).

Rhodophyta (Table 4) also represented by thirteen species (38.24%), twelve genera (46.15%). The result was completely different with South Aegean Sea (Greece) which dominated by 60 red algal taxa (Diapoulis and Tsiamis, 2007).

**Table (4): Distribution of red marine algae at Tolmeta coasts:**

<b>Rhodophyta</b>
<b><i>Acrosorium</i> Zanardini 1869</b>
<i>Acrosorium uncinatum</i> (J. Agardh) kylin
<b><i>Amphiroa</i> Lamouroux</b>
<i>Amphiroa rigida</i> Lamouroux
<b><i>Botryocladia</i> Kylin 1931</b>
<i>Botryocladia botryoides</i> (Wulf.) Feldmann
<b><i>Chondriopsis</i> J. Agardh 1863</b>
<i>Chondriopsis mediterranea</i> (Kütz.) J. Agardh
<b><i>Chrysmenia</i> J. Agardh 1842</b>
<i>Chrysmenia ventricosa</i> (Lamour.) J. Agardh
<b><i>Dermatolithon</i> Forslie</b>
<i>Dermatolithon pustulatum</i> (Lamouroux) Foslie
<b><i>Hypnea</i> Lamouroux 1813</b>
<i>Hypnea musciformis</i> (Wulfen) Lamouroux
<b><i>Jania</i> Lamouroux 1812</b>
<i>Jania adhaerens</i> Lamouroux
<i>Jania rubens</i> (Linnaeus) Lamouroux
<b><i>Laurencia</i> Lamouroux 1813</b>
<i>Laurencia papillosa</i> (Forsskål) C. Agardh
<b><i>Mesophyllum</i> Lemoine</b>
<i>Mesophyllum lichenoides</i> (Ellis ét Solmander) Lemoine
<b><i>Peyssonnelia</i> Decaisne 1842</b>
<i>Peyssonnelia elegella</i> Harvey
<b><i>Rytiphlaea</i> C. Agardh 1824</b>
<i>Rytiphlaea tinctoria</i> (Clemente) C. Agardh
Number of genus = 12    Number of species = 13

The R/P ratio is equal one at Tolmeta due to the balance of both Rhodophyta and Phaeophyta (13 species of each). Nizamuddin (1985) evaluated that eastern Libyan coasts were generally poor in algal growth and continuously exposed to rough conditions and fluctuating cold to mild weather because they belong to Pleistocene deposits. Nevertheless, R/P ratio of Rhodes Island, Greece was 3.5; this suggests a warm-temperate aspect of macroalgal flora (Tsiamis *et al.*, 2007).

*Padina pavonia* was the most dominant species at all samples, methanolic crude extract (at cold and 24 hours method) were tested against

*Escherichia coli* and *Staphylococcus aureus* bacteria and matched with some antibiotics by measuring the clear zones (Table 5). All of them were affected on *Escherichia coli* with overall mean 21.5, they could statistically ranked dissentingly as  $Ci > E15 > Sxt$  at the first rank and  $Te30 > Padina$  extract came at the second rank while P10 came at the third rank with significant values. Meanwhile, *Staphylococcus aureus* was affected only by E15 antibiotic. These may be due to the lower concentrations or the sampling program, time, method, drying, extraction and nature of organisms (Brooks, *et al.*, 2007). These results were more or less similar to those of some

green algae reported by El-Sal (2005) and El-Gahmy (2007). An ideal antimicrobial agent exhibits selective toxicity, which means that the drug is harmful to the host (Brooks, *et al.*, 2007). So, Crude extract used to be easy in addition to the main aim of this work to change the culture of many people to eat and treat with marine edible seaweeds (at least 500 Species) for their indefinite usefulness (Bilgrami and Saha, 1996; Dawes, 1998 and Nybakken, 2001).

Gonzalez del Val *et al.*, (2001) tested methanolic extracts of 44 Italian marine algal species as antifungal substances. Souhaili, *et al.*, (2004) used the ethanolic and water extracts of some marine algae of Morocco as antimicrobial agents meanwhile, the methanolic, chloroform and hexane extract were less

effective. Hafez, *et al.*, (2005) tested many extract of *Ulva lactuca* of Sweze canal of Egypt to prevent the growth of some gram positive and negative Bacteria and Fungi. Tüney, *et al.*, (2006) tested 11 Turkish marine algae against some pathogenic Bacteria which showed highly sensitivity. *Padina sps* grow and dominated in the shore of Kanyakumari and Ramanthapuram Districts of Tamilnadu State, India giving significant effect when tested against *Escherichia coli* and *Staphylococcus aureus* bacteria with special reference to methanolic extract and chloroform: methanol (2:1 v/v) where, methanolic extracts of *Padina sp.* were able to exhibit only 25-30% maximum activity against test organisms (Rajasulochana *et al.*, 2009).

**Table (5): Effect of crude methanolic extracts of *Padina Pavonia* and some antibiotics on *Escherichia coli* and *Staphylococcus aureus* growth (mm):**

Treatments		<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>
Overall mean		21.5	-
<i>Padina</i> extract		15.7b	-
Antibiotics	Sxt	26.2a	-
	E15	29.6a	13.6
	Cip	30.3a	-
	P10	8.7c	-
	Te30	18.5b	-

sxt: sulphatame thoxazole      e15: erythromycin  
cip: ciprofloxacin      p10: penicillin      te30: tetracycline

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## Evaluation of Biological Compounds of Streptomyces Species for Control of some Fungal Diseases

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**Abstract:** Fifty cases in cattle farm at Giza governorate were investigated. Some animals were suffered from clinical manifestations such as growth retardation, refused feeds, diarrhea, skin patches, cough and nasal discharge. Hundred samples of air, water supply and feeds including tibn, hay and processed feeds (20 of each) and Sixty samples of feces (of diarrheic animals) skin and nasal swabs (20 of each) were collected for fungal examination. The results revealed that 9 genera of moulds and 2 genera of yeasts were recovered from feed samples. The most predominant isolates of all types of feeds were the mould of genus *Aspergillus* particularly *A. flavus* (95%). Also, members of genus *Aspergillus* were predominantly recovered from most of samples of discharges as it were recovered (47.0 %). On the other hand, only one species of moulds was isolated from the skin scraping associated with skin lesion (*Trichophyton sp.*). Most of isolated *A. flavus* and *A. ochraceus* from animal feeds in diseased farms produced significant levels of aflatoxins and ochratoxins, respectively. The isolated *A. flavus* and *A. ochraceus* from tibn yielded a higher mean levels of aflatoxins and ochratoxins ( $2700 \pm 3.7$  and  $3250 \pm 2.5$ ppb), respectively. The antifungal effects of stationary or the exponential culture filtrate obtained from the strain of *Streptomyces sp.* were evaluated against the isolated pathogenic fungi. The results indicated that the stationary culture filtrate possessed a higher antifungal potential than the exponential culture filtrate. Where, the filtrate of the stationary phase of *Streptomyces sp.* yielded significantly wider range of antifungal activity zones ranged from  $7 \pm 0.69$  to  $11 \pm 1.41$  mm diameter compared with antifungal activity zone of the culture filtrate of the exponential phase which ranged from  $5 \pm 0.64$  to  $8 \pm 1.58$  mm diameter in comparison with benzoic acid as control which ranged from  $3 \pm 0.55$  to  $8 \pm 0.83$  mm diameter ( $P < 0.05$ ). The production of chitinase (6.0 u/mg protein) and  $\alpha$ -1, 3-glucanase (0.82- 0.35 u/mg protein) enzymes by *Streptomyces* were related to fungal growth inhibition and the biological control of fungal pathogens was possible because of the ability of *Streptomyces* to degrade fungal cell walls. MIC<sub>50-90</sub> of tested antimycotic drugs (Nystatin, Ketoconazole and Itraconazole) as will as *Streptomyces* extract were ranged from  $0.75 \pm 0.05$  to  $4 \pm 0.81$   $\mu$ g/ml against isolated yeasts (*Candida albicans* and *Rhodotorulla sp.*). *Streptomyces* exponential and stationary culture filtrate as will as its extract could be used as antifungal agent.

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**Key words:** Biological compounds ,Streptomyces species, fungal diseases, moulds, yeasts, *Aspergillus*, *Trichophyton*, aflatoxins and ochratoxins, antifungal activity, stationary, exponential, chitinase and glucanase

### 1. Introduction:

Fungal pathogens pose serious problems worldwide for both human and animal health, especially in the subtropical and tropical regions. Fungi and their toxin are natural contaminants of foods and feeds even when the best condition of culture, harvest, storage and handling were used. However the chemotherapeutic agents such as fungicidal drugs are causing residue hazards and deliberating action for human. Hence, up to date the active search for new pharmacologically active agents of natural sources was led to the discovery of many useful drugs which could play important role in treatment of many fungal and mycotoxin diseases with neither environmental pollution nor development of fungicide resistance pathogens. Serious researches are needed to identify alternative

methods for human and animal protection, which are less dependent on chemicals. Microbial antagonists are widely used for the biocontrol of fungal diseases. Such microorganisms include bacteria, algae and fungi, of such as bacterium of *Streptomyces spp* (Brimner and Boland, 2003). Many species of actinomycetes, particularly those belonging to the genus *Streptomyces*, are well known as antifungal biocontrol agents that inhibit several pathogenic fungi El-Tarabily *et al.*(2000); Xiao *et al.* (2002) ; Joo, (2005) and Errakhi *et al.*(2007). The antagonistic activity of *Streptomyces* to fungal pathogens is usually related to the production of antifungal compounds (Trejo-Estrada *et al.* (1998); Ouhdouch *et al.*(2001); Getha and Vikineswary.(2002); Fguira *et al.*(2005) and Taechowisan *et al.*(2005) and extracellular hydrolytic enzymes (Valois *et al.*

(1996) ;Mahadevan and Crawford (1997) ; Trejo-Estrada *et al.* (1998) and Mukherje and Sen (2006).

Chitinase and -1,3-glucanase are considered to be important hydrolytic enzymes in the lysis of fungal cell walls, as for example, cell walls of *Fusarium oxysporum*, *Sclerotinia minor*, and *S. rolfsii* (Singh *et al.* (1999); El-Tarabily *et al.* (2000) and El-Katatny *et al.* (2001)).The antifungal potential of extracellular metabolites from *Streptomyces* against some fungi was previously reported (Chamberlain and Crawford (1999); Joo,2005 and Fguira *et al.* 2005).However, data related to the antagonistic ability of the extracellular metabolites of *Streptomyces* strains to suppress the growth of the fungal pathogens *C. gloeosporioides* and *S. rolfsii* having a broad host range are limited (Errakhi *et al.* (2007). Therefore the aim of the present work was to screen the environment to fungal contamination and tested for its toxigenicity. Furthermore, evaluation of *Streptomyces* spp extracts as a biofungicidal compound .

## 2. Material and Methods

### Samples:

One hundred samples of air, water supply and feeds including tibn, hay and processed feeds (20 of each) and Sixty samples of feces (of diarrheic animals) skin and nasal swabs (20 of each) were collected from cattle farm at Giza governorate. Some animals were suffered from some clinical manifestation as diarrhea, cough, nasal discharge, growth retardation, refused feeds.

### Standards of aflatoxins and ochratoxin A:

Standards of aflatoxins B1, B2, G1 and G2 and ochratoxin A were purchased from Sigma Chemical Company (USA).

### Standards of antifungal agents:

Standards of Benzoic acid, Nystatin, Ketoconazole and Itraconazole were purchased from Sigma Chemical Company (USA).

### Isolation and identification of moulds:

The samples were subjected for isolation of fungi as recommended by (Refai, 1979) and it were classified according to the keys of Refai (1988) and Conner *et al.* (1992).

### Productions of aflatoxin by *A.flavus* A. (Gabal *et al.*, 1994) and *ochraceus* ochratoxin A (Davis *et al.*, 1966) by using liquid medium:

The produced aflatoxins and ochratoxins were extracted and estimated by fluorometric method as described by, Hansen, 1993.

### Microorganisms and culture conditions:

1-The fungal strains of fungi which predominantly isolates from the present samples were maintained on Sabouraud,s dextrose agar (oxoid) and grown in Sabouraud,s dextrose broth as described by (Cruikshank *et al.* 1975)

2-The bacterium: The used bacterial strains in this study was *Streptomyces* sp. Which recovered from soil and pure culture of the strain, *Streptomyces* sp. ANU 6277 was maintained on a yeast extract- malt extract- dextrose agar (ISP-2) medium. It was kept in 20% glycerol at -80°C (Cruikshank *et al.* 1975).

### Screening for the antagonistic activity of *Streptomyces* sp. against isolated fungi :

The strains of *Streptomyces* sp. were screened for their *in vitro* antagonism against the recovered fungi from cases of animal diseases according to the modified method of Crawford *et al.* (1993), Briefly, a 20-µl suspension of spores (10<sup>6</sup> spores/ml) of *Streptomyces* sp strain was spotted on one side of a potato dextrose agar (PDA) plate and incubated at 28 °C for 3 days. A mycelial plug of 6.0-mm diameter from 3-days-old of each fungus was cut and transferred to an *Streptomyces* sp pregrown PDA plate. The fungal plug was additionally placed on uninoculated PDA plates separately as control treatment. The radial fungal growth in the direction of the antagonist in both the control and the dual culture plates was measured at 4 to 6 days after incubation. The levels of inhibition were calculated by using the equation as previously mentioned by Yuan and Crawford (1995).

### Measurement of extracellular chitinase and -1, 3-glucanase in culture filtrate of *Streptomyces* sp.:

The strain of *Streptomyces* sp was grown in nutrient broth with continuous shaking at 150 rpm at 28 °C for 9 days. Cell-free supernatants were collected at 1-day intervals by centrifugation at 8,000 rpm for 20 min at 4 °C. Cell pellets were dried at 80 °C and weighed to determine the growth. Chitinase activity was quantitatively determined by the procedure described by Wang *et al.* (2002). The -1, 3-glucanase activity was measured according to the method of Singh *et al.* (1999), using laminarin from *Laminaria digitata* (Sigma, USA) as substrate. The amount of glucose released by the action of -1,3-glucanase enzyme was measured by using dinitrosalicylic acid solution (Miller, 1959). Total protein concentration was assayed by the method of using the Bio-Rad protein assay dry reagent (Bio-Rad, USA), with bovine serum albumin Bradford (1976).

### In vitro antifungal activity of extracellular metabolites in cell-free culture filtrates of *Streptomyces* sp. (Nakashima *e. al.*, 2002):

To prepare the cell-free culture filtrate of *Streptomyces* sp., the antagonist was cultured into SD broth and incubated on an incubator shaker (150 rpm) at 28 °C. The fermentation broth was collected during the exponential and stationary phases. Cells were removed by centrifugation at 8,000 rpm for 20 min at 4 °C. Cell-free supernatant was filtered aseptically through a sterile membrane with 0.45-µm pore size and stored at 4 °C. The growth inhibitory effects of the extracellular metabolites from culture filtrates were estimated by using the radial growth inhibition assay as described previously by Prapagdee *et al.* (2007) with some modifications. Fungal growth inhibition was expressed as the percentage of radial growth inhibition in comparison with the control (Benzoic acid as 100µg/ml)

#### Extraction of secondary metabolites

The fermentation process was carried out for six days at 30°C using liquid starch nitrate as production medium, filtered and centrifuged at 5000 r.p.m at pH 7.0 for 20 minutes (Guangying *et al.*, 2005). The clear filtrates containing the active metabolites was collected, and evaporated under reduced pressure using rotary evaporator at a temperature not exceeding 50°C. The active metabolites was precipitated by petroleum ether and centrifuged at 5000 rpm for 15 minute. Its color was pale yellow.

The purification of active metabolites was carried out using silica gel column (2.5 X 50) chromatography. Chloroform and Methanol 95:5 (v/v) (Guangying *et al.*, 2005) was used as an eluting solvent. The column was left overnight until the silica gel was completely settled. One-ml crude extract to be fractionated was added on the silica gel column surface and the extract was adsorbed on top of silica gel. Fractions were collected and tested for their antifungal activities. Only one band at  $R_f = 0.60$  showed antifungal activity, identified according to the recommended international references of Umezawa (1977) by ultraviolet (UV) absorption spectrum at 225-321 nm then used for determination of MIC.

#### Biological activity of the antifungal agent:

The minimum inhibitory concentration (MIC) has been determined by the cup method assay (Kavanagh, 1972).

#### Statistical analysis

The results (Mean  $\pm$  S.E) were calculated were analyzed by one-way analysis of variance (ANOVA) as explained by Petrie and Watson (1999). Significant differences at ( $p < 0.05$ ) using SPSS 15

### 3. Results and Discussion

Purification by then layer Chromatography: Table

Table (1): Prevalence of fungi at investigated air, water and feeds (n=20 for each type of samples).

Isolates	Air		Water		Feeds						
	+ve	%	+ve	%	Tibn		Hay		Processed		Total
					+ve	%	+ve	%	+ve	%	
<i>Aspergillus</i> spp.	5	25	8	40	20	100	20	100	17	85	95
<i>A.flavus</i>	3	15	2	10	15	75	20	100	17	85	86.6
<i>A.parasiticus</i>	4	20	1	5	10	50	2	10	10	50	36.6
<i>A.niger</i>	3	15	8	40	8	40	10	50	5	25	38.3
<i>A.ochraceus</i>	0	0	3	15	5	25	5	25	6	30	26.6
<i>A.fumigatus</i>	1	5	2	10	-	-	-	-	1	5	1.6
<i>A.candidus</i>	3	15	1	5	5	25	2	10	1	5	13.3
<i>Penicillium</i> spp.	1	5	1	5	11	55	11	55	14	70	60
<i>Fusarium</i> spp.	1	5	0	0	5	25	12	60	-	-	28.3
<i>Mucor</i> spp.	2	10	0	0	-	-	2	10	10	50	20
<i>Rhizopus</i> spp.	1	5	2	10	1	5	1	5	4	20	10
<i>Candida albicans</i>	2	10	6	30	-	-	-	-	5	25	8.3
<i>Rhodotorula</i> spp.	2	10	4	20	2	10	-	-	8	40	16.6
<i>Cladosporium</i> spp.	4	20	1	5	2	10	10	50	4	20	26.6
<i>Alternaria</i> spp.	2	10	0	0	8	40	10	70	2	10	40
<i>Curvularia</i> spp.	1	5	0	0	-	-	1	5	2	10	5
<i>Scopulariopsis</i> spp.	1	5	0	0	-	-	-	-	5	25	1.6

**Table (2): Prevalence of fungi in some body excretions from diseased animals (n=20 for each type of samples).**

Fungal Isolates	Feces		Skin scraping		Nasal Swabs		Total
	+ve	%	+ve	%	+ve	%	%
<i>Aspergillus spp.</i>	16	80	0	0	18	90	56.6
<i>A.flavus</i>	14	70	0	0	15	75	48.3
<i>A.parasiticus</i>	10	50	0	0	10	50	33.3
<i>A.niger</i>	8	40	0	0	12	60	33.3
<i>A.ochraceus</i>	10	50	0	0	9	45	31.6
<i>A.fumigatus</i>	2	10	0	0	18	90	33.3
<i>A.candidus</i>	1	5	0	0	6	30	11.6
<i>Penicillium spp.</i>	7	35	0	0	7	35	23.3
<i>Fusarium spp.</i>	1	5	0	0	1	5	3.3
<i>Mucor spp.</i>	1	5	0	0	1	5	3.3
<i>Rhizopus spp.</i>	0	0	0	0	0	0	0
<i>Candida albicans</i>	9	45	0	0	3	15	20
<i>Rhodotorula spp.</i>	2	10	0	0	1	5	5
<i>Cladosporium spp.</i>	2	10	0	0	1	5	5
<i>Alternaria spp.</i>	0	0	0	0	0	0	0
<i>Curvularia spp.</i>	0	0	0	0	1	5	1.6
<i>Scopulariopsis spp.</i>	0	0	0	0	1	5	1.6
<i>Trichophyton</i>	0	0	8	40	0	0	13.3
<i>T. verrucosum</i>	0	0	6	30	0	0	10
<i>T. mentagrophytes</i>	0	0	6	30	0	0	10

**Table(3) Screening of *A. flavus* isolated from feeds for production of aflatoxin B<sub>1</sub> (n=20 for each type of samples).**

Source of isolate	Incidence		Toxigenicity			Aflatoxin B <sub>1</sub> (ppb)		
	+ve	%	+ve	-ve	%	Max.	Min	Mean
Hay	15	75	10	5	33.3	5000	50	1700±5.2
Tibn	20	100	11	4	73.3	6300	35	2700±3.7
Processed feeds	17	100	7	10	41	2000	310	516±1.5

**Table(4) Screening of *A.ochraceus* isolated from feeds for production of Ochratoxin (n=20 for each type of samples)**

Source of isolate	Incidence		Toxigenicity			Ochratoxin (ppb)		
	+ve	%	+ve	-ve	%	Max.	Min.	Mean±S.E
Hay	5	25	3	2	60	7000	5000	583±0.2
Tibn	5	25	2	3	40	6300	200	3250±2.5
Processed feeds	6	30	3	3	50	3100	470	1400±1.5



**Table(5): Evaluation of the antifungal effect of bioactive compounds of streptomyces compared with Benzoic acid( 100 µg/ml) by using agar plate diffusion assay as inhibition zone diameter mm (n= 5).**

Tested fungi	Bioactive compounds of streptomyces sp		Benzoic acid
	Stationary culture filtrate	Exponential culture filtrate /	
<i>A.flavus</i>	11±1.30 <sup>A</sup>	5±0.73 <sup>a</sup>	4±0.71 <sup>a</sup>
<i>A.parasiticus</i>	10±1.00 <sup>A</sup>	8±0.68 <sup>B</sup>	5±0.69 <sup>ab</sup>
<i>A.fumigatus</i>	7±0.70	5±0.72	5±0.84
<i>A.ochraceus</i>	9±1.13 <sup>A</sup>	8±1.58 <sup>B</sup>	3±0.55 <sup>ab</sup>
<i>Penicillium spp.</i>	7±0.69	5±0.0.71 <sup>A</sup>	8±0.85 <sup>a</sup>
<i>Fusarium spp.</i>	8±0.71 <sup>A</sup>	5±0.73 <sup>a</sup>	5±1.05 <sup>a</sup>
<i>C. albicans</i>	11±1.41 <sup>A</sup>	7±1.14 <sup>a</sup>	6±1.22 <sup>a</sup>
<i>T.mentagrophytes</i>	7±0.73	5±0.69	5±0.83
<i>T. verrucosum</i>	8±0.71 <sup>A</sup>	7±0.84 <sup>B</sup>	4±0.68 <sup>ab</sup>

Small letters a and b in the same raw represent a significant change against capital letters A and B, respectively by LSD ( ANOVA) at P= 0.05

**Table (6): MIC of *C. albicans* yeasts isolated from clinical cases against tested antifungal compounds (n=15 ).**

Tested compounds	MIC rang (µ/ml )							
	0.125	0.25	0.5	0.75	1.0	2	3	4
Nystatin	R	1±0.15	5±0.43A	8±0.71A	10±1.14A	12±1.30A	13±0.45A	15±0.25
ketoconazole	R	1±0.46	3±0.45a	6±0.89	9±0.71	11±0.71B	12±0.71B	15±0.52
Itraconazole	R	1±0.52	3±0.44a	4±0.71a	7±0.32a	8±0.70ab	10±0.71ab	15±0.44
Streptomyces Extract	R	R	4±0.46	5±0.70a	8±0.72	9±0.72a	11±0.72a	15±0.63

Small letters a and b in the same raw represent a significant change against capital letters A and B respectively by LSD at P= 0.05 (ANOVA), R = resistant

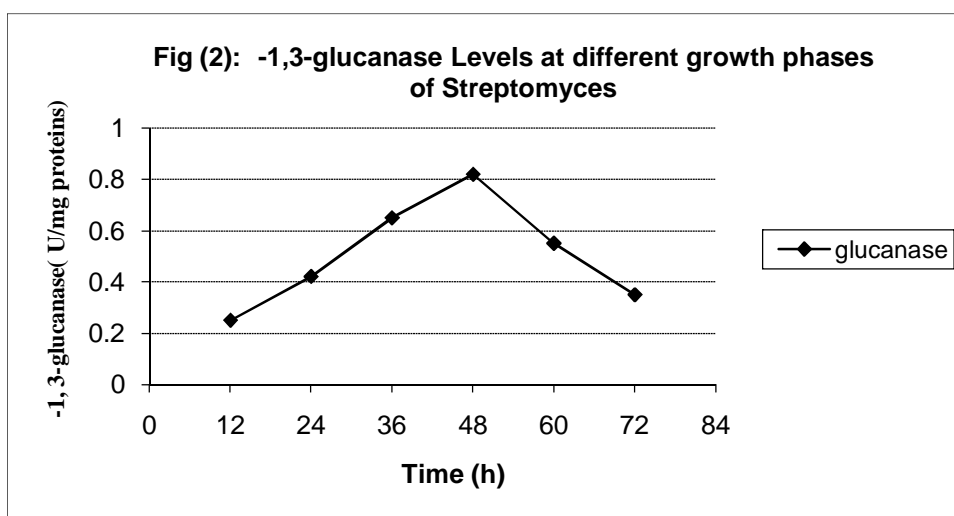
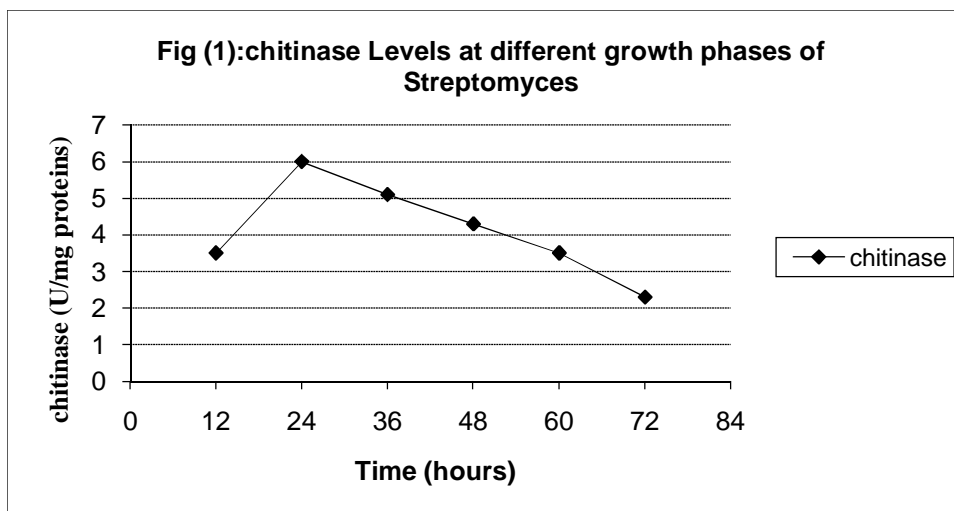
**Table (7): MIC range of *Rhodotorula* sp isolates from clinical cases against tested extract and some antifungals. (n=15).**

Tested compounds	MIC rang (µ/ml )							
	0.125	0.25	0.5	0.75	1.0	2	3	4
Nystatin	R	2±0.32	3±0.45	7±0.87A	8±0.71A	12±1.3A	14±0.32	15±0.55
ketoconazole	R	R	2±0.32	5±0.71	9±0.71B	11±0.71	13±0.55A	15±0.63
Itraconazole	R	R	3±0.45	4±0.71a	7±0.32b	9±0.71a	15±0.63a	15±0.55
Streptomyces Extract	R	R	2±0.32	5±0.71	6±0.71ab	10±0.89	14±0.55	15±0.63

Small letters a and b in the same column represent a significant change against capital letters A and B, respectively by LSD at P= 0.05 (ANOVA), R = resistant

**Table (8): MIC<sub>50-90</sub> of yeasts isolated from clinical cases against tested extract and some antifungals (µg/ml , n=15 ).**

Fungal isolates	Nystatin		Ketoconazole		Itraconazole		Strept.Extract	
	MIC <sub>50</sub>	MIC <sub>90</sub>	MIC <sub>50</sub>	MIC <sub>90</sub>	MIC <sub>50</sub>	MIC <sub>90</sub>	MIC <sub>50</sub>	MIC <sub>90</sub>
<i>C. albicans</i>	0.75±0.05	4 ±0.81	1 ±0.05	3 ±0.12	2 ±0.08	4 ±0.25	2±0.16	4±0.46
<i>Rhodotorulla sp.</i>	1 ±0.11	3 ±0.75	1 ±0.07	4 ±0.23	2 ±0.24	3 ±0.14	2±0.27	4±0.28



Mycosis and mycotoxicosis were progressively increased with the intensive environmental pollutions. In the present work, cattle were suffered from clinical manifestation as refused feeding, growth retardation, diarrhea, skin patches, cough and nasal discharge. One hundred samples of air, water supply and feeds including tbn, hay and processed feeds (20 of each) and Sixty samples of feces (of diarrheic animals) skin and nasal swabs (20 of each) were collected for fungal examination. Nine genera of mould and 2 genera of yeast were recovered from feed samples. The most predominant isolates of all types of feeds were the mould of genus *Aspergillus* particularly *A. flavus* (95%) (Table, 1). These results also reported previously by (El-Ghareeb and Khader, 2000 and Hassan *et al.*, 2009)

On the other hand, other genera as *Penicillium* sp. (60%), *Fusarium* sp. (28.3%) and *Alternaria* (40%) of mould were isolated in variable frequency. Whereas, the mould of *Curvularia* sp. were rarely isolated from feeds (5%). Also, members of genus *Aspergillus* were predominantly recovered from most of samples of 25% of air and 40% of water supply while, in animals discharges as it was recovered from 56.6 % of samples. It was recovered from 80% of faecal samples of cattle diarrhea and 90 % of nasal discharge of cattle suffered from pneumonia (Table, 2).

It was interesting to report that the yeast of *Candida albicans* was isolated in a significant frequency in all samples associated with diseases in cattle. It was isolated from 10% of air, 30% of water, 45% of feces (of diarrheic cases), 15% of nasal

discharge of pneumonic animal. Similar findings were previously reported by (Hassan *et al.*, 2007). Other genera of mould and yeast were also isolated in different frequencies. The *Penicillium species* and *Rhodotorula species* were the most significant fungi after the species of the *Aspergillus* and *C. albicans*. Only, one species of moulds was isolated from the skin scraping associated with skin lesion (*Trichophyton sp.*). These findings supported by the findings of (El-Refai *et al.*, 1977 and Hassan *et al.*, 2007) who reported that the isolation of *Trichophyton* from ring worm cases indicated that skin specially the rough keratin layer is the predilection site of these fungi. Whereas, other fungi could not be recovered from ring worm cases. This may be due to their inability to grow on rough layer of the skin of relatively higher temperature (up to 37°C).

Feeds beside other environmental factors suspected to play important role in animal infections. The dangers of mould and yeast besides causing animal mycosis, they produced fungal metabolites such as mycotoxins, such mycotoxins produced under adverse effect of environmental conditions. These mycotoxins residues in food and feed causes carcinogenic, teratogenic, haemorrhagic and immunosuppression effect to human and animal health (Sayed El Ahl *et al.*, 2006 and Hassan *et al.*, 2007).

Most of isolated *A.flavus* and *A.ochraceus* from animal feeds in diseased farm produced significant levels of aflatoxins and ochratoxins, respectively. The isolated *A.flavus* and *A.ochraceus* from tibia yielded a higher mean levels of aflatoxins and ochratoxins ( $2700 \pm 3.7$  and  $3250 \pm 2.5$  ppb, respectively) as seen in Table, 3 & 4. The detection of mycotoxin in feeds and environmental factors in association with other different animal diseases were also reported by Hassan *et al.* (2007).

The biological approaches to antifungal and mycotoxins detoxification will be taken as a mean of bio-transformation or degradation of toxin by endogenous enzyme to a metabolites that is either nontoxic when ingested by animal or less toxic than that the original toxin and readily extracted from the body. In the present study, the antifungal effects of stationary or the exponential culture filtrate obtained from the strain of *Streptomyces sp.* were evaluated against the pathogenic fungi that isolated from diseased cases. The results indicated that the stationary culture filtrate possessed a significantly higher antifungal potential than the exponential culture filtrate and benzoic acid (as control of antifungal activity). Where, the filtrate of the stationary phase of *Streptomyces sp.* yielded a wide range of antifungal activity zones ranged from

( $7 \pm 0.69$ - $11 \pm 1.30$  mm) in diameter. On the other hand, the antifungal activity zone (Table, 5) of the culture filtrate of the exponential phase not exceeded  $5 \pm 0.69$ - $8 \pm 1.58$  mm in diameter in comparison with benzoic acid ( $3 \pm 0.55$ - $8 \pm 0.85$  mm). These findings imply that the antifungal potential of the exponential culture filtrate was probably related to the increased production of hydrolytic enzymes, particularly chitinase. It has been reported that chitinase from *Streptomyces sp.* was able to lysis the cell walls of fungus (El-Katatny *et al.*, 2001). There is a possibility that the increased antifungal activity against the fungi tested in these experiments by the stationary culture filtrate of *Streptomyces sp.* is a consequence of the production of extracellular secondary antifungal compounds. The production of secondary antifungal compounds has been already reported in many species of *Streptomyces* (Fguira *et al.*, 2005 and Taechowisan *et al.*, 2005). Antifungal production by *S. hygroscopicus* can inhibit a broad range of fungal pathogens such as *Rhizoctonia solani*, *Pythium ultimum*, *F. oxysporum*, and *Sclerotinia homeocarpa* (Chamberlain and Crawford, 1999 a&b). In general both exponential and stationary culture filtrate of *Streptomyces sp.* could be used as antifungal (Table, 5). It has been reported that antifungal mechanism of antagonists has been attributed to the action of hydrolytic enzymes such as chitinase, -1,3-glucanase, chitosanase, and protease (Wang *et al.*, 2002). The production of extracellular chitinolytic and -1, 3-glucanolytic enzymes in the strain of *Streptomyces sp.* were determined at different growth phases. The strain produced relatively high levels of chitinase (6.0 U/mg proteins) at day 1 of the incubation period (Fig.1). Meanwhile, the highest level of -1, 3-glucanase (0.82 U/mg proteins) was found at day 2 of the incubation period (Fig.2) and subsequently decreased slightly during the stationary phase (0.35 U/mg proteins). As stated in many previous reports (Kawachi *et al.*, 2001), the production of chitinase and -1,3-glucanase enzymes by *Streptomyces* was related to fungal growth inhibition and the biological control of fungal pathogens due to the ability of *Streptomyces* to degrade fungal cell walls (Valois *et al.*, 1996; Mahadevan and Crawford, 1997 and Mukherjee and Sen, 2006).

Determination of minimum inhibitory concentrations (MIC) ranges of *C. albicans* and *Rhodotorula sp.* isolated from clinical cases against tested antifungal compounds (Tables 6, 7 & 8) showed that *Streptomyces* extract has antifungal activity significantly lower than Nystatin and near to ketoconazole and Itraconazole in most concentrations. It should be noted that one of the possible antifungal mechanisms of the *Streptomyces*

strain may be associated with the production of extracellular chitinase and  $\alpha$ -1,3-glucanase enzymes. The finding that extracellular metabolites in the culture filtrates of the strain inhibited the growth of pathogenic fungi supported the investigation of the effects caused by its metabolites on the growth of the fungus. It has been reported that chitinase and  $\alpha$ -1,3-glucanase enzymes are able to lyse fungal cell walls and are responsible for the suppression of fungal growth (Singh *et al.*, 1999). The antifungal agent of *S. violaceusniger* G10 showed *in vitro* antagonistic effects against *F. oxysporum* f.sp. *cubense*, such as hyphal swelling and the inhibition of spore germination (Getha and Vikineswary (2002). The fungal growth inhibition by the strain SAR14 is likely to be due to the presence of extracellular metabolites both hydrolytic enzymes and secondary antifungal compounds which could be used as alternative safe compounds for control of mycotic infections.

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**Certain Epidemiological Aspects of *Aeromonas hydrophila* Infection in Chickens****M. H. H. Awaad<sup>1</sup>, M. E. Hatem<sup>2</sup>, Wafaa A. Abd El-Ghany<sup>\*1</sup>, Asia El-Sawy<sup>3</sup> and A. Fathi<sup>2</sup>**<sup>1</sup>Poultry Diseases Department, Faculty of Veterinary Medicine, Cairo University, Egypt<sup>2</sup>Microbiology Department, Faculty of Veterinary Medicine, Cairo University, Egypt<sup>3</sup>Animal Health Research Institute, Cairo, Egypt<sup>\*</sup>[Wafaa.ghany@yahoo.com](mailto:Wafaa.ghany@yahoo.com)

**Abstract:** *Aeromonas hydrophila* (*A. hydrophila*) is one of enteric poultry pathogens of public health importance. This work was designed to investigate certain epidemiological aspects of *A. hydrophila* including its viability, cycle of infection and its pathogenicity to chicks. A gentamicin resistant *A. hydrophila* strain (GR *A. hydrophila* strain) was prepared. The results showed that GR *A. hydrophila* survived in water for 26 days at room temperature and also it could be persist in chicken crates, feces, ration, saw dust and straw for 11, 9, 23, 22 and 17 days, respectively. GR *A. hydrophila* could induce 8.3% embryonic mortality after dipping of the eggs in infected broth culture. Hatched chicks from GR *A. hydrophila* infected eggs showed mortalities reaching 13.3 and 1.7 % during 1<sup>st</sup> and 2<sup>nd</sup> week post hatching, respectively. Survived infected chicks exhibited signs and lesions of omphalitis, enteritis and septicaemia and depression in their weight gain. The rate of GR *A. hydrophila* re-isolation from dead embryos reached 100%, while it was 95.6, 26, 8.7, 4.4, 2.2 and 4.3% from intestine, liver, heart, spleen, kidney and lung, respectively in sacrificed survivors. Fecal shedding of GR *A. hydrophila* in chicken breeders revealed higher percentage in orally infected birds than subcutaneously infected ones. Addition of probiotic to the ration of orally infected group resulted in lowering the shedding rate. Re-isolation of the organism from egg shells reached 12 % in orally infected breeders compared to 4 % in orally infected probiotic treated birds. Samples taken from reproductive and internal organs of parent chicken hens were negative for GR *A. hydrophila* re-isolation. In conclusion; GR *A. hydrophila* survives for several weeks in contaminated water, ration and litter. The organism may infect birds by oral route and can colonize intestine. GR *A. hydrophila* is not congenitally transferred as ovary and oviduct do not play a role in dissemination of *A. hydrophila* infection. Addition of probiotic to the ration can reduce fecal shedding rate as well as re-isolation of *A. hydrophila* from the egg shells.

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**Key Words:** *Aeromonas hydrophila*, Chickens, Survival, Transmission

**1. Introduction:**

*Aeromonas hydrophila* (*A. hydrophila*) has been isolated from a wide range of mammals (Von and Zinterhofer, 1970), surface water and sewage (Hazen *et al.* 1978), fish and shell fish (Rippey and Cabelli, 1980), rabbits (Okewole *et al.* 1989 and Abdel-Gwad and Abdel-Rahman, 2004) as well as birds (Gerlach and Bitzer, 1971, Panigraphy *et al.* 1981, Glunder and Siegmann, 1989, Garcia *et al.* 1992, Jindal *et al.* 1993, FanDe *et al.* 1997, Akan *et al.* 1998, KeMin *et al.* 1998, Zeinab, 2007 and França *et al.* 2009). Moreover; *Aeromonas* species are considered as food born pathogens and of public health importance (Gracey *et al.* 1982, Altwegg, 1987, Altwegg and Geiss, 1989, Sarinehmetoglu and Kuplulu, 2001, Fukushema *et al.* 2007 and Chang *et al.* 2008).

*A. hydrophila* has a long survival rate in the environment (Araujo *et al.* 1991, Quinn *et al.* 1994, El-Khashab and El-Yazed, 2001 and Glunder, 2002).

Accordingly; this study was carried out in order to investigate certain epidemiological aspects of *A. hydrophila* including viability in drinking water and different chicken materials, cycle of infection as well as its pathogenicity to chicks.

**2. Materials and Methods:***Aeromonas hydrophila* strain:

A strain of *A. hydrophila* originally obtained from Animal Health Research Institute, Dokki, Egypt was used in this study. This strain has been isolated from an imported poultry meat meal and identified biochemically according to Bullock *et al.* (1971), Cruickshank *et al.* (1975), Popoff (1984) and Palumbo *et al.* (1985). For epidemiological investigation this strain has been rendered gentamycin resistant (GR *A. hydrophila*) using the method of Glunder and Siegmann, (1989) and Bisgaard *et al.* (1995) by successive subculturing in broth culture containing increasing quantities of gentamycin, starting with 2 µg/liter and ending by

100 mg/liter broth. This GR *A. hydrophila* strain proved to be able to grow on agar plates containing 100 mg gentamycin per liter.

Study on the viability of GR *A. hydrophila* in drinking water:

Viable bacterial cells of GR *A. hydrophila* was added to one liter of tap water in a rate of  $5 \times 10^9$  /ml (pH 6.7) in plastic trough and kept at room temperature (25°C). Bacterial samples were taken at the following schedule; every 3 hrs during the first 12 hrs post inoculation (PI), every 6 hrs PI during next 72 hrs, every 12 hrs PI during 4<sup>th</sup> to 7<sup>th</sup> days, once daily during 8–14 days PI, twice a week during 15–21 PI, and weekly during 3–7 weeks PI. Culturing was done by adding one ml of tested tap water to 9 ml nutrient gentamycin broth (containing 100 mg gentamycin/liter), incubated at 30°C for 24 hrs; then a loopful from resultant growth was streaked onto *Aeromonas* agar media as well as on MacConkey agar plate. The plates were similarly incubated for 24 hrs.

Study on the viability of *A. hydrophila* in different materials:

Sterile chicken crates, ration, feces, saw dust and straw were used in this experiment. Two hundreds grams of each sample were inoculated with  $5 \times 10^9$  viable bacterial cells of GR *A. hydrophila* broth culture per each gram then kept at room temperature (25°C). Samples were taken frequently in the following manner; day 1-3 PI twice daily, day 4-7 PI daily, day 8-23 PI every other day and day 24-45 PI weekly. Collected samples were inoculated into nutrient gentamycin broth, incubated at 30°C for 24 hrs then a loopful was streaked onto *Aeromonas* agar media as well as on MacConkey agar plate. The plates were incubated at 30°C for 24 hrs.

Study on the effect of dipping embryonated chicken eggs in *A. hydrophila* broth culture:

This method was done according to Zeinab *et al.* (2011). Eighty five, 18 day-old embryonated chicken eggs (ECEs) were divided into 2 groups (1 and 2). Those of group 1 were consisting of 60 eggs while those of group 2 were consisting of 25. Eggs of the 1<sup>st</sup> group were infected with GR *A. hydrophila* by dipping in 18 hrs chilled broth culture containing  $6.1 \times 10^9$  CFU/ml for five minutes. Those of the 2<sup>nd</sup> group were similarly dipped in sterile nutrient broth as a control. ECEs of both groups were further incubated with daily observation for embryo livability or mortality. Specimens including yolk sac, liver, heart and intestine of dead embryos were collected and subjected to bacteriological examination for GR *A. hydrophila* re-isolation. Liver

was taken from dead embryos for histopathological examination.

Hatched chicks from both groups were kept separately for 21 days with close observation for clinical signs and mortality. The body weight was taken weekly. Sacrificed survived chicks at the end of observation period were necropsied and the organs including intestine, liver, heart, spleen, kidney and lung were subjected for bacteriological examination in an attempt of GR *A. hydrophila* re-isolation. From dead as well as sacrificed chickens at the end of study (21 day old), specimens from liver, heart, intestine and lung were collected for histopathological examination.

Study on the cycle of *A. hydrophila* infection:

Experimental design:

Thirty-four; 33 week-old chicken breeders consisting of 30 hens and 4 cocks were assigned randomly into 4 groups (1-4). Those of groups 1-3 were consisting of 8 hens and one cock while the 4<sup>th</sup> group was consisting of 6 hens and one cock. Each chicken of groups 1 and 2 were orally inoculated with 2 ml of GR *A. hydrophila* containing  $1.5 \times 10^9$  CFU/ml. Chickens of group (1) were fed on a ration containing 0.5 kg / ton of a probiotic premix of selected lactic acid bacteria containing  $10^9$  CFU/g. of *Pediococcus acidilacti* produced by Lallemand Co.; France under the trade name Bactocell®, batch No. 402060 during the entire period of the experiment. Those of group (2) were fed on a plain ration without a probiotic. Chickens of group (3) were subcutaneously inoculated at the back of the neck with one ml/bird with GR *A. hydrophila* containing  $1.6 \times 10^9$  CFU/ml. Birds of group (4) were kept without infection or treatment as a blank control group. At the 3<sup>rd</sup> day PI; cloacal swabs were collected from each group daily during the 1<sup>st</sup> week PI and every other day during 2<sup>nd</sup> week PI to study the fecal (cloacal) shedding of GR *A. hydrophila*. Fertile eggs were collected for GR *A. hydrophila* re-isolation. At the end of the experiment, all parent chickens were sacrificed and specimens were collected from ovary, intestine, heart, liver, spleen, kidney, lung, brain and different parts of oviduct and subjected to bacterial re-isolation.

1. Re-isolation of GR *A. hydrophila* from fertile eggs:

One hundred fertile eggs were collected from the infected as well as non infected breeder hens (25 eggs/ group). These eggs were subjected to bacteriological examination for re-isolation of GR *A. hydrophila* from egg shell as well as from egg albumin and egg yolk after Shane and Gifford (1985) as follows: The eggs were stored for 5 days at 4°C before the outer shell and the internal egg contents

were cultured for GR *A. hydrophila*. For outer egg shell examination, the eggs were placed for 5 minutes in nutrient broth in sterile plastic bags and the broth was incubated at 30°C for 24 hrs before streaking on gentamycin *Aeromonas* agar and gentamycin MacConkey agar media. For internal egg examination, the yolk was cultured by swabbing the pointed end of the egg with 70% alcohol, puncturing the shell with a sterile forceps to drain out albumin without breaking the vitelline membrane. The vitelline membrane was then cut with sterilized scissors and 1 ml of yolk was collected with a syringe and incubated at 30°C for 24 hrs in 15 ml of nutrient broth before streaking on gentamycin *Aeromonas* agar and gentamycin MacConkey agar media.

## 2. Re-isolation of GR *A. hydrophila* from breeder hens:

After 2 weeks observation period, all chicken breeder hens groups (1-4) were sacrificed and specimens were collected from ovary, intestine, heart, liver, spleen, kidney, lung, brain and different parts of oviduct (infundibulum, isthmus, uterus and vagina). The collected samples were subjected to bacteriological examination for determination of localization sites of GR *A. hydrophila*. Sampling of organs on GR *A. hydrophila* was done as follows: yolk swabs collected from the interior of ovules after the exterior was sterilized by searing with spatula was placed into 10 ml of nutrient broth. The exterior of the oviduct was seared at the junction of the magnum and isthmus and 5-6 ml of nutrient broth was injected into the lumen. The posterior end of the oviduct was lifted slightly so that broth transferred almost the entire length of the magnum. After 5-10 minutes the content (2-3) ml from magnum were poured into tube containing 5-6 ml of nutrient broth. Similarly the exterior of the liver, spleen, heart, kidney, lung and brain were seared and their interiors were sampled in sterilized swabs then cultured. Moreover; contents of the caecum were also cultured. All specimens were cultured on nutrient broth and incubated at 30°C for 24 hrs then streaked on gentamycin *Aeromonas* agar and gentamycin MacConkey agar media.

## Histopathological Examination:

Specimens including liver, heart, intestine and lungs were collected from dead embryos as well as sacrificed hatched chicks, fixed in 10% formol, embedded in paraffin, sectioned and stained by hematoxylin and eosin stains (Banchroft *et al.* 1996) for histopathological examination through light microscope.

## 3. Results and Discussion:

The clinical significance of *A. hydrophila* was reported in several species of poultry as it caused septicaemia in turkeys (Gerlach and Bitzer, 1971), salpingitis in ducks (Bisgaard *et al.* 1995), diarrhea in water fowl (Efuntoye, 1995), conjunctivitis in pet parrots (Garcia *et al.* 1992), weight loss and diarrhea in cockatiels and canaries (Roskopf and Woerpel, 1996) and diarrhea, feathers picking, sleeping, growth retardation and fluffing in different avian species (Jindal *et al.* 1993, Dorrestein, 1997 and Ahmed 2004). *A. hydrophila* can cause localized or systemic infections in different avian species either alone or combination with other microorganisms (Barnes 1997).

As *A. hydrophila* is sensitive to gentamicin (FanDe *et al.* 1997, San *et al.* 1997 and Kelley *et al.* 1998), a gentamicin resistant *A. hydrophila* strain (GR *A. hydrophila* strain) was prepared for labeling purpose during the present investigation.

The viability of *A. hydrophila* in tap water was investigated under controlled laboratory conditions. The organism survived in water for 26 days at room temperature (25°C). This finding can explain why *A. hydrophila* organisms were isolated from water samples in high percentage during winter season. Opposite result was recorded by Rippey and Cabelli (1980) who found that *A. hydrophila* seemed to be seasonally distributed with maximum count during summer through early fall and this may be due to that the examined sample in this work was tap water which of low faecal pollution (Araujo *et al.* 1991). The association of *A. hydrophila* with water and fish (Schubert *et al.* 1972, Austin, 1987 and Humphrey *et al.* 1987) and also its isolation from wild birds (Glander and Siegmann, 1989) confirmed the long survival time of *A. hydrophila* in water which might result in the spread of infection within the flock. Our results agree with Kaper *et al.* (1981), Burke *et al.* (1984a, b), Arcos *et al.* (1988) and Varnam (1991) who reported on the isolation of *A. hydrophila* and other *Aeromonas* spp. from unchlorinated water supply. Legnani *et al.* (1998) studied the occurrence of *Aeromonas* spp. in drinking water supplies in a mountain area in northeast Italy as most of the isolates were identified as *A. hydrophila* and they suggested search for these micro-organisms should be adopted as a further indicator of drinking water quality. Also, Martone-Rocha *et al.* (2010) isolated *Aeromonas* spp. from wastewater treatment system.

The viability of GR *A. hydrophila* was investigated also in different material, simulating the flock condition to predict the mechanism of spread. Our findings showed that *A. hydrophila* persisted in chicken crates, feces, ration, saw dust and straw for 11, 9, 23, 22 and 17 days, respectively. Reviewing

the available literature, scanty literature reported on the viability of *A. hydrophila* in the previously mentioned materials. Rosskopf and Woerpel (1996) found that birds were usually exposed to infection with *A. hydrophila* through their food and transmission is primarily by oral routes with fecal shedding into environment. On the other side, Kelley *et al.* (1998) isolated *A. hydrophila* and other bacteria during the microbial evaluation of coarse fraction of litter for its reutilization as a bedding supplement in growing flocks of broilers.

The mortality rate of embryos and hatched chicks taken from GR *A. hydrophila* infected eggs and control non infected ones is shown in Table (1). The embryonic mortalities were 8.3% in GR *A. hydrophila* infected group as compared with 0% in non-infected control. This indicated the responsibility of *A. hydrophila* for inducing hatchability rate 91.7%. This finding assumed the possibility of transmission of GR *A. hydrophila* via egg shell penetration. This finding supported the results of Zeinab *et al.* (2011). Increased humidity and temperature as well as poor hygienic hatchery conditions are incriminated in provoking *A. hydrophila* infection via egg shell penetration. Musgrove *et al.* (2008) isolated *A. hydrophila* and other enterobacteria from the eggs shell of chickens. Dead embryos exhibited severe congestion of the liver, myocardium and yolk sac. Moreover, hatched chicks from GR *A. hydrophila* infected eggs showed mortalities reaching 13.3 and 1.7 % during 1<sup>st</sup> and 2<sup>nd</sup> week post hatching, respectively as compared with 0% in non-infected control. Survived infected chicks exhibited omphalitis, ruffling feathers, general weakness, inappetance and enteritis. At necropsy; hatched survivors from GR *A. hydrophila* infected eggs revealed enteritis, omphalitis, unabsorbed yolk sac, distended gall bladder and congestion of liver and heart. Gerlach and Bitzer (1971) described septicaemic condition in commercial turkeys aged 3-16 weeks that was attributed to *A. hydrophila* infection with 10-30% morbidity rate and 1-5% mortality rate. The synergistic relationship between *Salmonella* spp. and *A. hydrophila* infections in newly hatched poult was studied by Saif and Busch (1974) who found that both organisms together produced 30% mortality but neither of them produced mortality when inoculated individually. Furthermore, Shane and Gifford (1985) reported that 2-4 day-old experimentally infected chicks were highly susceptible to *A. hydrophila* exposure via subcutaneous, yolk sac or intracerebral routes with mortality rate ranging 80-100%. Glunder (1988 and 1989) isolated *A. hydrophila* from 80 birds from a total of 2236 purchased birds. He found that mono infection was found in 4 cases while in all other cases,

*A. hydrophila* infection was combined with the presence of Enterobacteriaceae and/or *Streptococci* or *Staphylococci*. Cases of high mortality of waterfowl at several locations of Germany were observed where *A. hydrophila* organism was isolated (Korbel and Kösters, 1989). El-Khashab (2001) experimentally infected 2 and 5 day-old chicks with *A. hydrophila* organism via yolk sac, intramuscular, subcutaneous or oral inoculations. The results revealed that some chicks died acutely while chicks that died later demonstrated a transitory period of depression characterized by ruffled feathers and pasty vent before death with mortality rate ranging 60-100%. She also observed generalized congestion of liver, spleen, lungs, kidneys, intestine (especially duodenum) with severe haemorrhagic enteritis. Moreover, there were streaks of haemorrhages on the liver's surface. Ahmed (2004) found that *A. hydrophila* induced acute death within 24 hrs of the inoculated chicks with 100% mortality rate after yolk sac inoculation and 86.6% after subcutaneous inoculation. The most predominant lesions findings were generalized venous congestion, petechial haemorrhages on the liver, omphalitis, enteritis and nephrosis. Also, Epidemic deaths of Mallard ducks after infection with *A. hydrophila* were detected by Zbikowski *et al.* (2006).

Table (2) reveals the body weight gain of hatched chicks from GR *A. hydrophila* infected eggs and control non infected ones. The hatched chicks showed numerical difference in their weights between chicks taken from GR *A. hydrophila* infected eggs and these from non infected ones reached to 5, 30 and 103 grams at 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> week of age, respectively. This result explains the economic losses that may result from *A. hydrophila* infection in chickens. This finding supported those of Yadov and Verma (1998) and Kutkat *et al.* (2001) who observed retardation of growth in chicks infected with *A. hydrophila*. In addition, Ahmed (2004) detected weight gain loss in *A. hydrophila* experimentally infected chicks when compared with control birds.

From Table (3), it is observed that the rate of GR *A. hydrophila* re-isolation from dead embryos (yolk sac, liver, heart and intestine) reached 100 %. While in sacrificed survivors, the rate of re-isolation was 95.6, 26, 8.7, 4.4, 2.2 and 4.3% from intestine, liver, heart, spleen, kidney and lung, respectively. The isolation of *A. hydrophila* from the intestine of infected birds indicates intestinal colonization (Gracey *et al.* 1982). Isolation of the organism from liver, spleen, kidneys and lungs can be explained by infection via the blood stream (bacteraemia) (Gunder and Siegmann, 1989). Recovery of GR *A. hydrophila* from extra-intestinal organs is in accordance with the findings of Shane *et al.* (1984),



El-Gohary and Amal (2002) and Zeinab *et al.* (2011). Shane and Gifford (1985) isolated *A. hydrophila* from the yolk sac, heart blood, lung, brain and cloacal swabs of experimentally infected chicks. In addition, Ocholi and Kalejaiye (1990) isolated *A. hydrophila* from liver, lung and intestine of ground hornbill suffering from haemorrhagic septicemia with haemorrhage in internal organs. Ahmed (2004) re-isolated *A. hydrophila* from heart blood and liver of experimentally infected dead chicks. Recently, *A. hydrophila* was isolated in pure culture from intestine, liver, lungs and trachea of adult ostriches died with severe necrotizing enteritis and septicemia (França *et al.* 2009).

Considering the histopathological examination results, Figure (1) reveals that dead embryos from GR *A. hydrophila* infected eggs showed severe dilatation of hepatic blood vessels in addition to mild hemorrhages. Two-days old dead chicks hatched from GR *A. hydrophila* infected eggs showed dispersion of hepatocytes with necrobiotic changes in some of hepatic lobules and congestion of the coronary blood vessels with intramuscular oedema of the heart muscles. Figure (2) clears that twenty one day-old sacrificed chickens taken from GR *A. hydrophila* infected eggs showed pronounced oedema in addition to peripheral coagulative necrosis of the liver cells, oedema with intramuscular aggregation of inflammatory cells (mainly lymphocytes) in the cardiac muscles, hemorrhages in the intestinal villi, pulmonary oedema with pronounced alveolar congestion and the tertiary bronchioles showed subepithelial hemorrhage in the lung. These findings were similarly recorded by Ahmed (2004) and Zeinab *et al.* (2011).

To investigate the pattern of cloacal (fecal) shedding of *A. hydrophila* in infected chicken breeders, the results are investigated in Table (4). Fecal shedding of inoculated GR *A. hydrophila* revealed higher percentages in orally infected chickens (group 1 and 2) than subcutaneously infected one (group 3). However, addition of probiotic to the ration of orally infected group (group 1) resulted in lowering shedding than non-treated group (group 2). The isolation of GR *A. hydrophila* from 13% of fecal samples of raptors was reported by Needham *et al.* (1979). Moreover; Jindal *et al.* (1993) isolated motile *Aeromonads* from the droppings of 2 out of 10 poultry cases. Similarly, Ahmed (2004) isolated *A. hydrophila* from the cloacal samples of experimentally infected chicks for up to 16 days post infection. The long faecal shedding rate of *A. hydrophila* explains the serious health hazard of the pathogen especially when occur in broilers

associating with an increase in the intestinal count and possible carcass contamination in poultry slaughter house. So using of probiotics for controlling of this infection is important to reduce the human health hazard.

Re-isolation of GR *A. hydrophila* from the internal egg contents (yolk) showed negative results. Results of re-isolation of GR *A. hydrophila* from outer egg shells that collected from chicken breeder groups are illustrated in Table (5). It was clarified that re-isolation of the organism from the egg shells reached 12 % in orally infected chickens whereas it reached 4 % in orally infected probiotic treated birds. No re-isolation (0%) of GR *A. hydrophila* could be determined in subcutaneously infected birds as well as in blank control ones. These results draw attention to the role of oral infection of *A. hydrophila* as a possible route of vertical transmission through intestinal colonization and contamination of egg shells during their passage via the cloaca and also spots light on the usefulness of probiotic usage in controlling vertical transmission via this route. Efuntoye (1995) and Akan and Diker (1996) identified *A. hydrophila* from different chicken' flocks when watery droppings containing mucous were examined.

No clinical signs could be noticed in GR *A. hydrophila* infected breeders via oral or subcutaneous routes. Furthermore; samples including ovary, intestine, heart, liver, spleen, kidney, lung, brain and different parts of oviduct that collected from sacrificed parent chickens gave negative results for GR *A. hydrophila* re-isolation.

In conclusion; our results are indicating that *A. hydrophila* survives for several weeks in contaminated water, ration and litter. The organism may infect birds by oral route and can colonize intestine as a part of intestinal flora. *A. hydrophila* is not congenitally transferred. It assumes a persistent nature during which shedding occurs and egg contamination takes place during the intestinal passage, therefore it seems that ovary and oviduct do not play a role in dissemination of *A. hydrophila* infection. Also, addition of probiotic to the ration can reduce fecal shedding rate as well as re-isolation of *A. hydrophila* from the egg shells.

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**Table (1): The mortality rate of embryos and hatched chicks taken from GR *A. hydrophila* infected ECEs and control non infected ones**

Parameter	No. of ECEs	Embryonic mortalities		Chicks mortalities during 21 days observation						Survival chicks	
				1 <sup>st</sup> Week		2 <sup>nd</sup> Week		3 <sup>rd</sup> Week			
		No.	%	No.	%	No.	%	No.	%	No.	%
Group 1 (Infected ECEs)	60	5	8.3	8	13.3	1	1.7	0	0	46	76.7
Group 2 (Control ECEs)	25	0	0	0	0	0	0	0	0	25	100

ECEs = Embryonated chicken eggs

Necropsy findings:

- Dead embryos: Congestion of the liver, myocardium and yolk sac.
- Dead chicks: Enteritis, omphalitis, unabsorbed yolk sac, distended gall bladder and congestion of liver and heart.

**Table (2): The body weight gain of hatched chicks from GR *A. hydrophila* infected eggs and control non infected ones**

Week Chicks	Body weight gain (chick / gram)		
	1 <sup>st</sup> Week	2 <sup>nd</sup> Week	3 <sup>rd</sup> Week
<b>Group (1)</b>	93	190	320
<b>Group (2)</b>	98	220	423
<b>Difference</b>	5	30	103

Group (1): Hatched chicks from GR *A. hydrophila* infected eggs.

Group (2): Hatched chicks from control non infected eggs.

**Table (3): Re-isolation of GR *A. hydrophila* from infected 18-days old dead embryos and sacrificed survived chickens**

Re-isolation from dead embryos		Re-isolation from survived chickens					
No. of dead embryos/total No. of eggs	No. of Positive cases	Intestine	Liver	Heart	Spleen	Kidney	Lung
5/60	*5/5	*44/46	*12/46	*4/46	*2/46	*1/46	*2/46
8.3 %	100 %	95.6 %	26 %	8.7 %	4.4 %	2.2 %	4.3 %

\*No. of positive cases/total No. examined.

**Table (4): Cloacal (fecal) shedding of GR *A. hydrophila* from chicken breeders**

Days PI	Group (1)			Group (2)			Group (3)			Group (4)		
	No. of samples	+	%	No. of samples	+	%	No. of samples	+	%	No. of samples	+	%
3	8	3	37.5	8	8	100	8	2	25	8	0	0
4	8	1	12.5	8	7	87.5	8	1	12.5	8	0	0
5	8	2	25	8	8	100	8	0	0	8	0	0
6	8	0	0	8	3	37.5	8	0	0	8	0	0
7	8	1	12.5	8	6	75	8	0	0	8	0	0
8	8	0	0	8	2	25	8	0	0	8	0	0
9	8	0	0	8	1	12.5	8	0	0	8	0	0
11	8	0	0	8	2	25	8	0	0	8	0	0
13	8	0	0	8	1	12.5	8	0	0	8	0	0
15	8	0	0	8	0	0	8	0	0	8	0	0

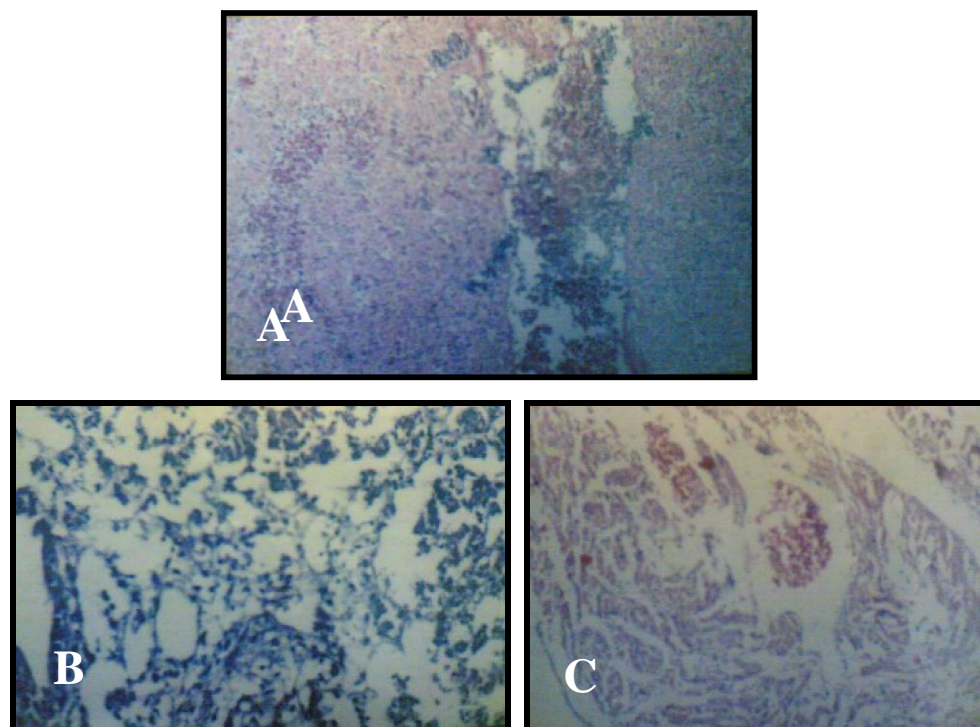
PI= post infection    += Positive    %= Percentage

Group (1): Orally infected with GR *A. hydrophila* and treated with probiotic

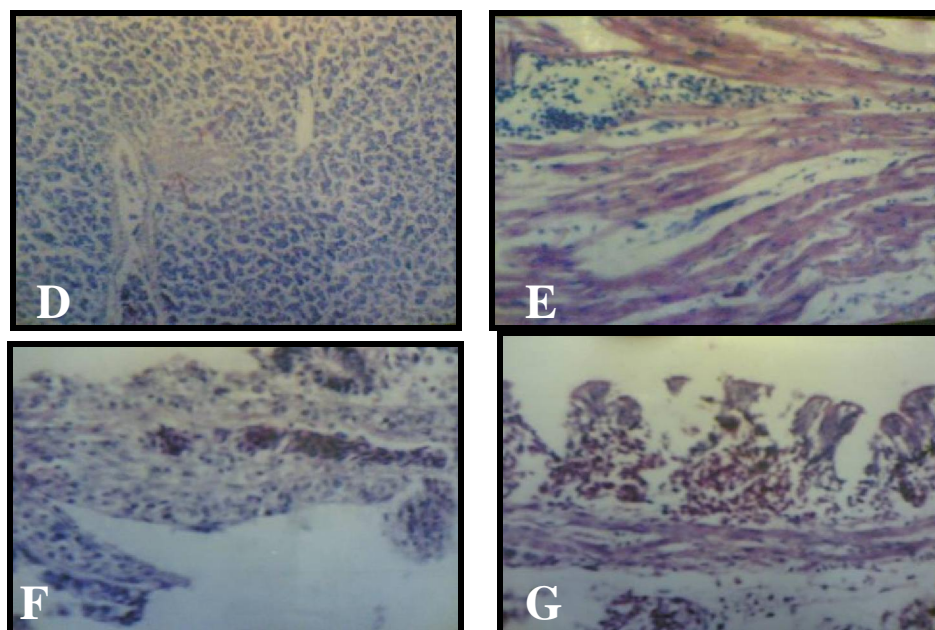
Group (2): Orally infected with GR *A. hydrophila* and not treated with probiotic

Group (3): Subcutaneously infected with GR *A. hydrophila*

Group (4): Blank control non infected or treated



**Figure (1):** Dead embryos from GR *A. hydrophila* infected eggs showed severe dilatation of hepatic blood vessels in addition to mild hemorrhages (A). Two days old dead chicks hatched from GR *A. hydrophila* infected eggs showed dispersion of hepatocytes and some of hepatic lobules showed necrobiotic changes (B) and congestion of the coronary blood vessels with intramuscular oedema of the heart muscles (C).



**Figure (2):** Twenty one day-old sacrificed chickens taken from GR *A. hydrophila* infected eggs showed pronounced oedema in addition to peripheral coagulative necrosis of the liver cells (D), oedema with intramuscular aggregation of inflammatory cells (mainly lymphocytes) in the cardiac muscles (E), hemorrhages in the intestinal villi (F) and pulmonary oedema, pronounced alveolar congestion, and the tertiary bronchioles showed subepithelial hemorrhage in the lung (G).

**Table (5):** Re-isolation of GR *A. hydrophila* from the outer egg shells collected from chicken breeders

No. of eggs	Group (1)		Group (2)		Group (3)		Group (4)	
	+	%	+	%	+	%	+	%
25	1	4	3	12	0	0	0	0

Group (1): Orally infected with GR *A. hydrophila* and treated with probiotic

Group (2): Orally infected with GR *A. hydrophila* and not treated with probiotic

Group (3): Subcutaneously infected with GR *A. hydrophila*

Group (4): Blank control non infected or treated

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## Synthesis and Biochemical Evaluation of Some Substituted Phthalazines

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**Abstract:** The chemistry of phthalazine derivatives has been of increasing interest since many of these compounds have found chemotherapeutic applications. So this study aims to synthesize series of phthalazine derivatives, and investigate the antihyperglycemic, antihyperlipidemic and antibacterial activities of these derivatives. The influence of some synthesized phthalazine derivatives administered orally was studied in diabetic rats. Rats were divided into 5 equal groups. Group I: control rats. Group II: diabetic rats serving as a reference group for the treated groups. Groups III, IV and V: diabetic rats received a daily oral dose of 3mg/kg from each tested derivative for 15 days. At the end of the experimental period, serum levels of glucose, lipid profile and non-esterified fatty acids were assayed. Other phthalazine derivatives were tested against four pathogenic bacterial strains. The tested derivatives improved significantly serum levels of glucose, lipid profile and free fatty acids. Some phthalazine derivatives exhibited interesting high activity against Gram +ve bacteria than those of Gram -ve. Conclusion: This study reports interest findings that the tested phthalazine derivatives have antihyperglycemic and antihyperlipidemic effects at the adopted sublethal dose. The type of chemical derivatization of phthalazine confers glucose and lipid lowering activities as well as antibacterial activity.

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**Keywords:** *Phthalazinone, Chlorophthalazine, Thiophthalazine, Diabetes, Triacylglycerol, fatty acids.*

### 1. Introduction:

Diabetes mellitus (DM) is one of the most common chronic diseases in nearly all countries, and continues to increase in affected numbers and significance (Shaw *et al.*, 2010). Diabetes is not simply a disorder of glucose homeostasis but is also accompanied by various degenerative manifestations such as cardiovascular disease which is partly due to associated abnormalities of plasma lipid and lipoprotein metabolism (Dunn, 2010). Dyslipidemia characterized by elevated triglycerides (TG), reduced high density lipoprotein-cholesterol (HDL-C) and elevated plasma free fatty acids (FFA) levels (Kreisberg, 1998).

The chemistry of phthalazinone is very well known. These systems are widely used in organic chemistry as intermediates for the synthesis of numerous compounds. On the other hand; phthalazine derivatives were extensively studied as bioactive compounds. They possess remarkable biological activity, such as anticonvulsant, antimicrobial and anti-inflammatory (Abd alla *et al.*, 2010). A series of 5-[4-[2-substituted phthalazinones-2(or 4yl) ethoxy] phenylmethyl] thiazolidine-2,4-diones showed the best lowering activity for plasma glucose and triacylglycerol *in vitro* and *in vivo* pharmacological studies (Madhavan *et al.*, 2001).

Consequently, this study aims to synthesize series of novel phthalazine derivatives and extends to

investigate the anti-hyperglycemic and anti-hyperlipidemic activities of some of these derivatives. In addition, the antibacterial activity of these derivatives was also examined.

### 2. Materials and methods

All chemicals and solvents were of high analytical grade and were purchased from Sigma Chemical Company. Infrared spectra (IR) were performed by Pye Unicam SP<sup>3</sup>-200 spectrophotometer with samples embedded in KBr discs. Varian spectrometer was utilized for NMR spectra with TMS as internal reference. Mass spectra were recorded by FINNI-Gas 3300 mass spectrometer operating at 70 eV beam energy.

#### a) Synthesis of substituted phthalazine derivatives:

The title compounds were synthesized according to the synthetic route in Scheme 1. The starting material 4-Biphenyl-4-yl-2H-phthalazin-1-one (**1**) [C<sub>20</sub>H<sub>14</sub>N<sub>2</sub>O of molecular weight (m.wt.) 298, melting point (m.p.) 252°C] was prepared according to the method reported by Soliman *et al.*, (1990).

#### 3-(4-Biphenyl-4-yl-1-oxo-1H-phthalazin-2-yl)-propionitrile (**2**):

Acrylonitrile (0.01mol) was added to 0.01mol of (**1**) dissolved in 20ml pyridine and refluxed for 10 hrs. After cooling, the product was

poured onto ice/HCl mixture and the solid that separated was filtered off, washed well with water and recrystallized from benzene to give yellow crystals [ $C_{23}H_{17}N_3O$ , m.wt. 351, m.p. 235°C and yield 25%].

### 2-acetyl-4-Biphenyl-4-yl-2H-phthalazin-1-one (3):

Acetyl chloride (0.01mol) was added to 0.01mol of (1) dissolved in 30ml of pyridine and refluxed for 10 hrs. The solid obtained after concentration and cooling was recrystallized from benzene [ $C_{22}H_{16}N_2O_2$  with m.wt. 340, m.p. 225°C and yield 25%].

### (4-Biphenyl-4-yl-1-oxo-1H-phthalazin-2-yl)-acetic acid ethyl ester (4):

A mixture of 0.01mol of (1), 0.04mol of ethylchloroacetate and 0.04mol of anhydrous potassium carbonate in 50ml of dry acetone was refluxed for 24 hrs. on a steam bath. The excess solvent was then removed by distillation and the reaction residue was poured onto water. The separated solid was filtered off, and recrystallized from ethanol to give white crystals [ $C_{24}H_{20}N_2O_3$  with m.wt. 384, m.p. 200°C and yield 90%].

### 4-Biphenyl-4-yl-1-oxo-1H-phthalazin-2-yl)- acetic acid hydrazide (5):

A mixture of 0.01mol of the ester (4) and 0.01mol of hydrazine hydrate in 50ml of ethanol was refluxed for 10 hrs. The solid that separated after concentration and cooling was recrystallized from acetone to give white crystals [ $C_{22}H_{18}N_4O_2$  with m.wt. 370, m.p. 252°C and yield 75%].

### General procedure for the synthesis of 6a-c:

To 0.01mol of (4) in 30ml of absolute ethanol and 0.05mol of sodium ethoxide and different aromatic aldehydes namely (salicylaldehyde, *p*-methoxy benzaldehyde and *o*-bromobenzaldehyde) were added and refluxed for 2hrs. The precipitate was filtered off on hot and recrystallized from the proper solvent to give: 2-(4-Biphenyl-4-yl-1-oxo-1H-phthalazin-2-yl)-3-(4-methoxy-phenyl)-acrylic acid ethyl ester (6a), 2-(4-Biphenyl-4-yl-1-oxo-1H-phthalazin-2-yl)-3-(2-hydroxy-phenyl)-acrylic acid ethyl ester (6b) and 2-(4-Biphenyl-4-yl-1-oxo-1H-phthalazin-2-yl)-3-(2-bromo-phenyl)-acrylic acid ethyl ester (6c) (Tables 4,5).

### 1-biphenyl-4-yl-4-chlorophthalazine (7):

A mixture of 0.01mol of (1), 0.01mol of phosphorus pentachloride and 10ml phosphorus oxychloride was refluxed for 3 hrs. on a steam-bath.

After cooling the reaction mixture was poured carefully onto ice/HCl mixture. The solid that separated was filtered off, washed well with water, dried and recrystallized from benzene to give pale

yellow crystals [ $C_{20}H_{13}N_2Cl$ , m.wt. 316.5, m.p. 200°C and yield 82%].

### 6-Biphenyl-4-yl-3-methyl-[1,2,4] triazolo [4,3-a]phthalazine (8):

A mixture of 0.01mol of (7) and 0.01mol of acetyl hydrazine in 40ml of *n*-butanol was refluxed for 48 hrs. The solid that separated after concentration and cooling was filtered off and recrystallized from ethanol as white crystals with molecular formula  $C_{22}H_{16}N_4$ , m.wt. 336, m.p. 235°C and yield 60%.

### 1-Biphenyl-4-yl-4-methoxy phthalazine derivative (9):

A mixture of 0.01mol of (7) and 0.01mol of sodium methoxide was refluxed for 8 hrs in 30 ml methanol as solvent. The solid that separated after concentration and cooling was filtered and recrystallized from ethanol as white crystals [ $C_{21}H_{16}N_2O$ , m.wt. 312, m.p. 180°C and yield 70%].

### General procedure for the synthesis of (10a-g):

A mixture of 0.01mol of (7) and 0.01mol of amines namely, hexamine, benzyl amine, *p*-aminobenzoic acid, *p*-chloroaniline *o*-amino-acetophenone, *p*-aminobenzophenone and/ or hydrazine hydrate was refluxed for 6 hrs. in 40ml of *n*-butanol. The solids that separated were recrystallized from the proper solvent to

### 2-(4-Biphenyl-4-yl-phthalazin-1-yl)-2H-benzotriazole [1,2,3]- oxadiazine (11):

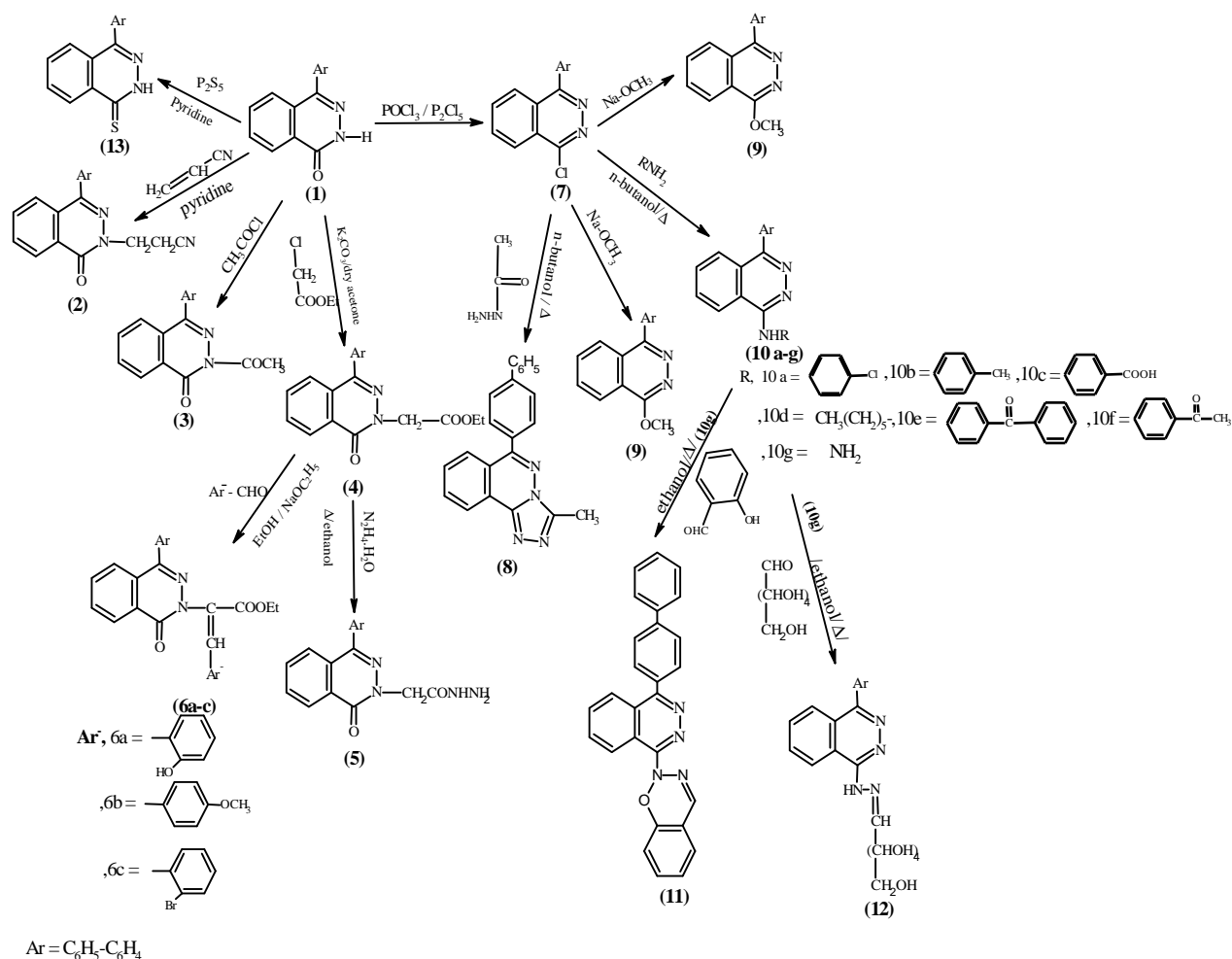
A mixture of 0.01mol of (10g) and 0.01mol of the salicylaldehyde in 40ml ethanol was refluxed for 6 hrs. The solid that separated, after concentration and cooling, was filtered off and recrystallized from ethanol [ $C_{27}H_{17}N_4O$ , m.wt. 413, m.p. 220°C and yield 60%].

### 6-[(4-Biphenyl-4-yl-phthalazin-1-yl)-hydrazono]-hexane-1,2,3,4,5-pentaol (12):

To 0.01mol of 10g a (0.01 mol) of glucose was added in 40ml ethanol and refluxed for 6 hrs. The solid that separated after cooling was filtered off and recrystallized from ethanol [ $C_{26}H_{26}N_4O_5$ , m.wt. 474, m.p. 180°C and yield 70%].

### 4-Biphenyl-4-yl-phthalazine-1-thiol (13):

A mixture of (1) (0.01mol) and phosphorus pentasulphide (0.02mol) in 40ml of dry pyridine was refluxed for 6 hrs. After cooling the reaction mixture was poured onto ice/HCl mixture. The solid that separated was filtered off, washed with water, dried and recrystallized from petroleum ether (b.p. 60–80°C) to give deep yellow crystals [ $C_{20}H_{14}N_2S$ , m.wt. 314, m.p. 110°C and yield 75%].



Scheme 1: Synthetic methodology for phthalazine derivatives.

### b) Biochemical studies:

Induction of diabetes mellitus in rats was carried out by a single i.p. injection of freshly prepared alloxan monohydrate solution at a concentration of 120 mg/kg body weight after a fast of 12 h (Refaie *et al.*, 2005). After 3 days of diabetes induction, treatment with the synthesized drugs was begun and lasted for 2 weeks. The tested compounds were orally administered to animals at a sublethal dose level of 3 mg/kg body weight (Madhavan *et al.*, 2001). Body weight of the animals in all groups was recorded weekly until the end of the experiment. All rats were assorted into 5 equal groups (10 rats each) according to the following scheme: **Group I (NC)**: comprised normal rats fed a commercial pellet diet and left intact without any treatment. **Group II (DC)**: involved diabetic rats serving as a reference group for the treated groups. **Group III (D+1)**: diabetic rats treated with (1). **Group VI (D+11)**: diabetic rats received a daily oral dose of (11). **Group V (D+13)**: diabetic rats treated with (13).

At the end of the experimental period blood samples were taken from the retro-orbital venous plexus under light ether anesthesia after a fast of 12 hours. Serum was prepared by centrifuging blood samples at 4000 rpm for 5 min. Serum samples were aliquoted and stored at -20°C until analysis, except for glucose which was determined on the same day without delay. Non hemolyzed sera were analyzed for liver function tests (aspartate and alanine amino transferases (AST & ALT, respectively) using assay kits (SpinReact Diagnostics, Spain), while albumin was determined by the enzymatic colorimetric method of Dumas *et al.*, (1971). Kidney function tests (urea and creatinine) were assayed by methods of Patton and Crouch (1977), Heinegård and Tiderström (1973), respectively. Serum levels of glucose, total lipids, cholesterol and triacylglycerol were assayed by enzymatic colorimetric methods using assay kits (SpinReact Diagnostics, Spain). HDL-C was determined according to the method of Assmann *et al.*, (1983), while low and very low

density lipoprotein-cholesterol (LDL-C & VLDL-C, respectively) were calculated according to **Freidwald et al., (1972)** formulae. Non-esterified fatty acids were analyzed by Shimadzu GC 17-A gas chromatograph equipped with an auto-injector AOC 17 and a flame ionization detector (Shimadzu Corporation, Japan).

### Anti-microbial Studies:

The anti-microbial activities were performed according to the method of **Bauer et al., (1966)** for compounds illustrated in table 5. These compounds were tested against Gram positive (G +ve) (*Staphylococcus aureus* and *Bacillus subtilis*) and Gram negative (G -ve) (*Escherichia coli* and *Pseudomonas aeruginosa*) bacteria. These strains were obtained from the Regional Center for Mycology and Biotechnology, Al-Azhar University, Cairo, Egypt. Chloramphenicol was used as anti-bacterial reference standard.

### Statistical analysis:

All results were expressed as mean  $\pm$  SD. The data were analyzed by one-way analysis of variance (ANOVA). To compare the least significant difference among the groups, post hoc testing was performed by the LST test. The p-value less than 0.05 was considered statistically significant (**Dawson and Trapp, 2001**). Statistical analysis was performed with Statistical Package for the Social Science for Windows (SPSS, version 11.0, Chicago, IL, USA).

### 3. Results

The structures of the synthesized compounds were confirmed with spectral data as illustrated in tables (1-5). Fragmentations of derivatives **2**, **4** and **5** were as follow: m/z 351(0.10%), at m/z 298(100%), at m/z 241 as [M+2] (27.95%), m/z 165(7.78%), m/z 88(1.19%) and m/z 76 (1.37%) for (**2**) and 368(13.58), m/z 298 (100%), m/z 221 (80.86%), m/z 144(13.73%), m/z at 70(17.16%) and m/z 77(24.87%) for (**4**), while for (**5**) was 339(0.03%), m/z 338(0.05%), m/z 281(14.22%), m/z 297(87.07%), m/z 310(0.34%) and m/z 163(26.49%). The m/z (%) for **6b**: 502(2.08%), m/z 205(1.9%), m/z 298(39.357%), m/z 221(48.71%), m/z 167(24.36%), m/z 133(7.23%), m/z 107(25.34%), m/z 73(34.07%) and m/z 77(57.20%). Derivatives **10** showed the following fragmentation pattern in MS m/z (%): (**10a**): 312(0.09), 297 [M+1](100), 220(4.62), 164(10.01) and 57(0.11). For (**10c**): 133(0.33), 297(100) as [M+1], 221(5.52), 164(4.82) and 57(0.08). For (**10d**): 145(6.73) as [M+3], 297(100) as [M+1], 221(88.53), 164(17.38) and 57(8.16) as [M+3]. For (**10f**): 415(1.52), 119(20.99), 77(17.31), 298(100) (the second main ion peak),

221(27.71), 164(0.71) and 57(1.29). For (**10g**): 407(75.32), 327(2.22), 298(1.18), 221(0.46), 164(3.11) and 57(0.43).

Data in table (6) showed significant elevation ( $p < 0.001$ ) in serum levels of AST and ALT activities in diabetic control, compared to normal control. Administration of compounds 11 and 13 to diabetic rats improved significantly ( $p < 0.01$ ) the enzymes activity, compared to diabetic control. Compound 13 treated rats showed non significant alteration in serum AST but a remarkable reduction ( $p < 0.01$ ) was noticed in serum ALT activity as compared to CD group. Serum albumin levels showed non significant alteration in all studied diabetic groups as compared to control group. Significant elevations were observed in serum urea ( $p < 0.01$ ) and creatinine ( $p < 0.05$ ) in CD, compared to CN. Administration of the phthalazine derivatives improved serum levels of urea as compared to CD. Serum levels of creatinine were within the normal range in all groups, although it showed significant elevation ( $p < 0.05$ ) in rats treated with compound 13, compared to normal rats.

Table (7) demonstrated that serum level of glucose was significantly elevated ( $p < 0.001$ ) in CD and D+1 groups, compared to normal group. Oral administration of either compound 11 or 13 decreased significantly ( $p < 0.01$ ) serum glucose level as compared to CD group.

Diabetic control rats showed significant elevation in all lipid parameters except for HDL-C, which was significantly reduced ( $p < 0.01$ ), compared to normal rats. Rats treated with compounds 1 and 13 improved significantly the lipid profile except HDL-C which was not affected by the two drugs compared to CD rats. In addition, compound 1 could not affect the serum cholesterol level of the diabetic rats treated with this compound. In regard, compound 13 improved significantly all the lipid parameters as compared to control group. Serum level percent of palmitic acid was non significant in all groups. Stearic acid level was elevated significantly ( $p < 0.01$ ), while levels of oleic and linoleic were significantly decreased ( $p < 0.05$ ) in CD rats, compared to normal rats. Animals treated with compound 11 revealed normal serum levels of both stearic, oleic and linoleic acids, while serum level of  $\alpha$ -linolenic was significantly reduced as compared to control animals. Rats treated with compound 13 showed non significant alterations in stearic and oleic acids levels and significant reduction ( $p < 0.01$ ) in serum level of  $\alpha$ -linolenic acid, in addition to significant elevation ( $p < 0.01$ ) in linoleic acid level, compared to CD group. Administration of compound 1 improved significantly serum fatty acids levels, compared to CD group.

Data in table (8) demonstrated that the lowering effect of compound 11 on the serum levels of total lipids, cholesterol, TG, LDL-C and stearic acid was more significant than those of compounds 1 and 13. The decreasing effects of either compound 11 or 13 on the serum levels of glucose and LDL-C were more pronounced than compound 1. However, effects of compound 13 in lowering the levels of serum TG, VLDL-C and linoleic acid were more potent than the two other phthalazine derivatives.

Data in table (9) revealed that **10g** was the most potent phthalazine derivative against bacterial

strains, in addition, it was as potent as chloramphenicol. Compounds 1, 5, 7 and 10d were effective in inhibiting the growth of *Bacillus subtilis*, but still less effective than standard drug. The anti-bacterial activity of compounds 3, 5, 7, 10d and g were greater than the rest compounds on *E. coli*. In regard with *Pseudomonas aeruginosa*, the tested phthalazine derivatives showed mild inhibitory activity as noticed by compounds 1, 5, 7, 10d and 10g, while the rest compounds had no activity.

**Table (1): Selected mass (MS) and infrared (IR) spectral data for compounds 1-5**

Comp.	MS m/z(%)	IR ( $\text{cm}^{-1}$ )						
		NH	NH <sub>2</sub>	OH	C=O	C=N	C-N	CH
1	298 (100)	3377	---	3297	1650.8	1585.3	---	---
2	298 (100)	---	---	---	1663.1	1541	---	3097(Ar) 2990-2855 (Al)
3	---	---	---	---	1700 (acetyl) 1661 (phthalaz.)	1555.3	---	---
4	298 (100)	---	---	---	1659.8 (ring) 1756.1 (ester)	1553.6	---	---
5	297 (87.07)	3101.46	3157.86	---	1650.77 (amide)	1605.45	1261.7- 1212.04	---

**Table (2): Elemental analysis (EA) (calculated and found values) and <sup>1</sup>H NMR data of compounds 1-5**

Comp.	EA (Cal/ Found)			<sup>1</sup> H-NMR		
	C	H	N	ppm	Splitting	Type of proton
1	80.54/ 80.53	4.70/ 4.68	9.40/ 9.39	7.535-8.420 12.946	M s	13 Ar-H 1 NH
2	78.63/ 78.60	4.84/ 4.82	11.97/ 11.95	----	----	----
3	77.65/ 77.64	4.71/ 4.70	8.24/ 8.23	----	----	----
4	75/ 75.02	5.21/ 5.20	7.29/ 7.30	7.535-8.420 1.858-3.102 3.202-3.891	M t q	13 Ar-H CH <sub>3</sub> CH <sub>2</sub>
5	71.33/ 75.02	4.86/ 4.83	15.14/ 15.13	----	----	----

**Table (3): Selected mass, infrared spectral data and elemental analysis as well as <sup>1</sup>H NMR data.**

Comp.	MS m/z (%)	IR ( $\text{cm}^{-1}$ )			EA (Cal/ Found)					<sup>1</sup> H-NMR		
		NH	C=N	C-Cl	C	H	N	Cl	S	ppm	Splitting	Type of proton
7	---	---	1663.3	847.56	75.82/ 75.83	4.10/ 4.11	8.84/ 8.85	11.21/ 11.22	---	7.55- 7.93	m	13H, Ar-H
8	296 (100)	---	1680- 1602	---	78.57/ 78.55	4.76/ 4.74	16.66/ 16.67	---	---	7.12- 8.63 2.128	m  s	13H, Ar-H  3H, CH <sub>3</sub>
9	298 (100)	3374.49	1664.75	---	80.76/ 80.77	5.12/ 5.13	8.97/ 8.98	---	---	---	---	---
11	298 (100)	---	---	---	78.45/ 78.43	4.12/ 4.10	13.56/ 13.54	---	---	---	---	---
12	---	---	---	---	65.82/ 65.80	5.48/ 5.49	11.81/ 11.80	---	---	---	---	---
13	---	---	---	---	76.43/ 76.40	4.45/ 4.46	8.91/ 8.92	---	10.19/ 10.20	---	---	---



**Table (4):Elemental analysis (EA) (calculated and found values) and <sup>1</sup>H NMR data of compounds 6-10**

Comp.	EA (Cal/ Found)				<sup>1</sup> H-NMR	
	C	H	N	Cl	ppm	Splitting, Type of proton
<b>6a</b>	76.22/ 76.20	4.91/ 4.92	5.73/ 5.74	----	12.21 6.35-7.945 2.133-3.559	s, 1H, Ar-OH m, 17H, Ar-H d, 2H, CH=CH
<b>6b</b>	76.49/ 76.50	5.17/ 5.18	5.57/ 5.58	----	----	----
<b>6c</b>	67.51/ 67.50	4.17/ 4.16	5.80/ 5.90	14.51/ 14.52	----	----
<b>10a</b>	81.88/ 81.90	7.08/ 7.10	11.02/ 11.10	----	7.485-7.935 12.92	m, 17H, Ar-H s, 1H, NH
<b>10b</b>	83.72/ 83.70	5.42/ 5.43	10.85/ 10.86	----	----	----
<b>10c</b>	76.56/ 76.54	4.41/ 4.42	10.07/ 10.10	----	----	----
<b>10d</b>	76.56/ 76.54	4.41/ 4.42	10.30/ 10.31	8.71/ 8.72	----	----
<b>10e</b>	80.96/ 80.95	5.06/ 5.10	10.12/ 10.10	----	----	----
<b>10f</b>	83.01/ 83.20	4.82/ 4.80	8.81/ 8.81	----	----	----
<b>10g</b>	76.92/ 76.90	5.12/ 5.13	17.34/ 17.35	----	----	----

**Table (5): IR spectra ( ,cm<sup>-1</sup>) for compounds 6 and 10.**

Comp.	C-H	C=O	C=C	C=N	CH <sub>2</sub>	CH <sub>3</sub>	NH	NH <sub>2</sub>	OH
<b>6a</b>	2931.75- 2890.29	1678.25	1602.56	1550.01	----	----	----	----	3500
<b>6b</b>	2934.16- 2894.15	1649.8	1599.66	1509.99	----	----	----	----	----
<b>6c</b>	2998.28- 2935.13	1650.29	1585.68	1548.56	----	----	----	----	----
<b>10a</b>	3098.56	----	----	1553.86	1450.21	1399.1	3298.64	----	----
<b>10b</b>	2940.91	----	----	1662.34	----	----	3156.90	----	----
<b>10c</b>	2995.39	1662.34	----	1585.20	----	----	3157.86	----	----
<b>10d</b>	3055.66	----	----	1584.24	----	----	3393.14	----	----
<b>10e</b>	2996.84	1665.71	----	1591.47	----	1356.68	3338.18	----	----
<b>10g</b>	2918.73	----	----	1611.23	----	----	3159.79	3379.64	----

**Table (6): Liver and kidney function tests (Mean±SD) for the different studied groups.**

Parameters	Experimental groups				
	CN	CD	D + 1	D + 11	D + 13
AST(U/L)	117.00±9.66	196.3±14.18*	132.67±32.33 <sup>#</sup>	137.0±22.72 <sup>#</sup>	185.67±53.81*
ALT(U/L)	50 ±8.53	111.33±39.36*	53.0±17.06 <sup>#</sup>	59.83±14.25 <sup>#</sup>	63.67±21.45 <sup>#</sup>
Albumin(mg/dl)	2.17±0.41	1.67±0.52	1.83±0.41	1.67±0.52	1.83±0.41
Urea(mg/dl)	30.67±3.14	64.83±13.29*	49.67±17.78 <sup>#</sup>	37.83±3.43 <sup>#</sup>	49.00±6.00 <sup>#</sup>
Creatinine(mg/dl)	1.44±0.27	1.74±6.12*	1.59±0.11	1.62±0.14	1.69±0.19*

\* Significant vs control normal, # significant vs control diabetic.

**Table (7): Serum levels of glucose and lipid profile as well as percent of free fatty acids (Mean±SD) in the different studied groups.**

Parameters	Experimental groups				
	CN	CD	D + 1	D + 11	D + 13
Glucose(mg/dl)	114.67±12.52	582.83±20.40*	496.83±56.29*	304.83±176.58*#	254.33±111.33*#
Total lipid(mg/dl)	50.67±5.57	79.17±11.79*	47.00±9.67#	26.33±4.23*#	54.83±8.79#
Cholesterol(mg/dl)	52.00±12.29	88.83±27.29*	81.33±2.73*	34.33±3.83*#	69.50±15.96*
TG (mg/dl)	64.17±18.35	173.67±55.86*	54.33±14.89#	86.67±18.91#	126.5±39.17*#
HDL-C(mg/dl)	41.67±2.58	20.50±5.50*	40.33±1.37#	22.33±4.89*	36.67±3.20*#
LDL-C (mg/dl)	12.17±3.66	64.50±16.18*	50.83±5.67*	33.67±17.81*#	48.00±17.29*#
VLDL-C(mg/dl)	12.83±3.67	34.73±11.17*	10.87±2.97#	17.33±3.78#	24.27±7.24*#
Palmitic(16:0)	26.00±7.67	25.50±3.83	29.50±1.64	25.50±3.83	25.5±6.02
Stearic(18:0)	10.00±1.09	19.00±2.19*	14.50±3.83*#	10.50±3.83#	20.33±2.58*
Oleic (18:1)	22.50±0.55	18.00±3.29*	19.50±1.64	24.50±4.93#	18.50±4.93
-Linol(18:3 3)	12.50±3.83	15.00±3.29	8.83±4.62#	7.50±2.74*#	7.33±0.82*#
Linoleic(18:2 6)	16.50±0.55	11.50±5.92*	12.67±5.99	18.50±0.55#	20.00±1.09#

\* Significant vs control normal, # significant vs control diabetic.

**Table (8): Statistical comparison of the tested derivatives on different serum parameters (Mean±SD)**

Parameters	Experimental groups		
	D + 1	D + 11	D + 13
Glucose (mg/dl)	496.83±56.29 <sup>a</sup>	304.83±176.58 <sup>b</sup>	254.33±111.33 <sup>b</sup>
% Change vs CD	-14.76	-47.69	-56.36
Total lipid (mg/dl)	47.00±9.67 <sup>a</sup>	26.33±4.23 <sup>b</sup>	54.83±8.79 <sup>a</sup>
% Change vs CD	-40.63	-66.74	-30.74
Cholesterol(mg/dl)	81.33±2.73 <sup>a</sup>	34.33±3.83 <sup>b</sup>	69.50±15.96 <sup>a</sup>
% Change vs CD	-8.44	-61.35	-21.76
Triglycerides(mg/dl)	54.33±14.89 <sup>ab</sup>	86.67±18.9 <sup>a</sup>	126.5±39.17 <sup>b</sup>
% Change vs CD	-68.71	-50.09	-27.16
HDL-C(mg/dl)	40.33±1.37 <sup>a</sup>	22.33±4.89 <sup>b</sup>	36.67±3.20 <sup>a</sup>
% Change vs CD	96.73	8.93	78.88
LDL-C (mg/dl)	50.83±5.67 <sup>a</sup>	33.67±17.8 <sup>b</sup>	48.00±17.29 <sup>ab</sup>
% Change vs CD	-21.19	-47.79	-25.58
VLDL-C(mg/dl)	10.87±2.97 <sup>ab</sup>	17.33±3.78 <sup>a</sup>	24.27±7.24 <sup>ac</sup>
% Change vs CD	-68.70	-50.10	-30.12
Stearic(18:0)	14.50±3.83 <sup>a</sup>	10.50±3.83 <sup>b</sup>	20.33±2.58 <sup>c</sup>
% Change vs CD	-23.68	-44.74	7.0
Oleic (18:1)	19.50±1.64 <sup>a</sup>	24.50±4.93 <sup>b</sup>	18.50±4.93 <sup>a</sup>
% Change vs CD	8.33	34.21	2.78
Linoleic(18:2 6)	12.67±5.99 <sup>a</sup>	18.50±0.55 <sup>b</sup>	20.00±1.09 <sup>b</sup>
% Change vs CD	10.17	60.87	73.91

Each similar letters are non significant.

**Table (9): Anti-bacterial activity of the phthalazine derivatives (5 ug/ml) against tested bacterial strains with regard to chloramphenicol (5 ug/ml) as a reference standard.**

Compound	G +ve		G -ve	
	<i>Staph. Aur.</i>	<i>Bacil. Sub.</i>	<i>E. coli</i>	<i>Pseud. aer.</i>
1	+	++	+	+
3	+	+	++	0
4	+	+	+	0
5	+	++	++	+
7	+	++	++	+
10 d	+	++	++	+
10 g	++	++	++	+
11	+	+	+	0
12	+	+	+	0
13	+	+	+	0
chloramphenicol	++	+++	++	++

+ = 0.1-0.5cm, ++ = 0.6-1.0cm, +++ = 1.1-1.5cm and 0 = no effect.

#### 4. Discussion:

Effective blood glucose control is the key for preventing or reversing diabetic complications and improving quality of life in patients with diabetes. Thus, sustained reduction in hyperglycemia will decrease the risk of developing microvascular complications and most likely reduce the risk of macrovascular complications (Jarald *et al.*, 2009).

Compound (1) is treated either with acrylonitrile in boiling pyridine, with acetyl chloride in the presence of few drops of pyridine or with ethyl chloroacetate in dry acetone containing anhydrous potassium carbonate to give derivatives (2), (3) and (4), respectively. Compound (4) was confirmed chemically by its reaction with hydrazine hydrate in boiling ethanol to give derivative (5). All these compounds were confirmed on the basis of their spectral data.

Compound (4) was also confirmed by its reaction with aromatic aldehydes under Claisen reaction conditions to give the arylidene derivatives (6a-c) which were confirmed on the basis of their spectral data.

As a point of interest, the phthalazinone derivative (1) exists in lactam-lactim tautomeric equilibrium. Thus, in absence of solvent or in presence of a weakly polar solvent, it reacts with electrophiles or nucleophiles in the lactim form. So, compound (1) was reacted with a nucleophilic reagent such as phosphorous oxychloride to give the corresponding chlorophthalazine (7). Compound (7) was confirmed chemically by its reaction with acetylhydrazine in boiling n-butanol for 48 hrs. to give phthalazine derivative (8). Also, (7) was confirmed chemically by its reaction with sodium methoxide under reflux to give (9). These compounds were confirmed on the basis of their spectral data. The MS for derivative (8) was 336(0.19%) which underwent fragmentation to give ion peaks at  $m/z$  321(0.03%) which loss C N molecule to give the main ion peak  $m/z$  296 as  $[M+2]$  (100%) which underwent fragmentation to give ion peaks at  $m/z$  220(2-35%),  $m/z$  164(3.63%) and  $m/z$  56(0.01%). Derivative (9) MS was 312(0.11%) which loss  $H^+$  to give ion peak at  $m/z$  311(0.11%) which underwent fragmentation to give main ion peak at  $m/z$  298(100%) which underwent fragmentation to give ion peaks at  $m/z$  221(17.38%),  $m/z$  164(2.5%),  $m/z$  57(0.03%) and  $m/z$  77(3.09%).

In addition, compound (7) was treated with different primary aliphatic and aromatic amines and/or hydrazine hydrate, in boiling n-butanol to give the corresponding 1-amino phthalazine derivative (10a-g). Compound (10g) was confirmed chemically by its reaction with aromatic aldehyde or with aldohexose in boiling ethanol under reflux to give Schiff's base (11) or pentaol derivative (12) which were confirmed on the basis of their spectral data.

The presence of the lactam form was proved by the reaction of phthalazinone (1) with phosphorous

pentasulphide in the presence of pyridine as a solvent to give the thione derivative (13).

In order to assess the toxic side effects of the administered dose levels of phthalazine derivatives (1, 11 and 13), the change percent of body weight gain at each week point with respect to the initial body weight was recorded but non significant alterations were observed (data not shown). In addition, both the liver and kidney function tests were determined. The diabetic hyperglycemia induced by alloxan produces elevation of serum levels of ALT and AST, as well as levels of urea and creatinine in untreated diabetic rats, while albumin level was not affected. These results agree with those of Jarald *et al.*, (2009). Administration of either derivative 11 or 13 improved significantly the hepatic enzymes activities. In spite, the improvement of ALT activity produced by 13, but it did not reduce AST activity. However, the three tested derivatives improved the kidney function. This indicates that 1 and 11 are safer than 13 at the adopted dose levels.

The present results indicate the efficiency of 11 and 13 to reduce the levels of serum glucose, while 1 did not affect the serum glucose level in alloxan-induced diabetic rats. The present results are in line with Madhavan *et al.*, (2001) who reported that a series of substituted phthalazinones containing thiazolidinediones showed plasma glucose and plasma triglyceride lowering activity in db/db mice.

Quinazoline, which is isomeric with phthalazine, possesses hypoglycemic and hypolipidemic effects (Refaie *et al.*, 2005). These effects in both compounds could be attributed to being cyclic amidine compounds. In addition, metformin, a well known hypoglycemic drug, which acts as an inhibitor of hepatic glucose production, possesses guanidine and amidine functionalities in its molecular structure. Another class of compounds, such as triaryl imidazoles, have also an amidine moiety in a cyclic structure, displayed a significant glucagon antagonistic property (Wu *et al.*, 1990). Consequently, the tested compounds produced their effects due to the amidine and guanidine part in their structure.

The levels of serum lipids are usually elevated in diabetes mellitus and such an elevation represents a risk factor for coronary heart disease (Pushparaj *et al.*, 2007). The present work illustrates significant elevation in all lipid parameters except for HDL-C, which was significantly reduced in diabetic rats, compared to normal group. Rats treated with the three tested derivatives improved significantly the serum total lipids. In spite 11 and 13 reduced significantly serum cholesterol and triacylglycerol levels, 1 reduced only the elevated triacylglycerol as compared with the diabetic reference group. These

results agree with those reported by **Madhavan et al., (2001)**.

This abnormal high level of serum lipids is mainly due to the uninhibited actions of lipolytic hormones on the fat depots mainly due to the action of insulin, since under normal circumstances, insulin activates the enzyme lipoprotein lipase, which hydrolyses triglycerides. However, in diabetic state lipoprotein lipase is not activated due to insulin deficiency resulting in hypertriglyceridaemia (**Pushparaj et al., 2007**). In addition, insulin has an inhibitory action on 3-hydroxy-3-methyl glutaryl Co A (HMG- Co A) reductase, a key rate-limiting enzyme responsible for the metabolism of cholesterol-rich LDL particles (**Murali et al., 2002**). In regard to serum lipoproteins profile, derivatives **11** and **13** reduced serum LDL-C and VLDL-C levels, while **1** reduced serum VLDL-C level, compared to their reference group. Compound **11** did not affect significantly serum HDL-C level as the other two derivatives.

These findings suggest that the reduction effect of derivatives **11** and **13** on serum cholesterol and triacylglycerol levels may be due to inhibition of HMG- Co A reductase as well as inhibition of the esterification reactions of both. However, compound **1** inhibits the synthesis of hepatic triacylglycerol since VLDL synthesized in liver and mainly contains TG.

It is known that a heterocyclic containing carbonyl group is more efficacious than a simple heterocyclic (**Watanabe et al., 1994**). In regard to the tested derivatives, **11** was more potent as hypolipidemic since its percent changes were more valuable than compounds **1** and **13**, in spite **13** improved significantly all the lipid parameters as compared to control diabetic group. This activity of compound **11** may be related to its chemical structure which possesses high electron density due to the presence of four nitrogen atoms in addition to the oxygen atom, while **13** was more active than **1** due to the presence of sulfur atom with its higher number of electrons than the oxygen atom in compound **1**.

Plasma free fatty acids (FFA) play important physiological roles in skeletal muscle, heart, liver and pancreas. Fatty acids are increased in diabetic patients (**Yin et al., 1997**). Elevated FFA concentrations are linked with the onset of peripheral and hepatic insulin resistance (**Boden and Shulman, 2002**).

The present work revealed that serum stearic acid level was elevated significantly, while levels of oleic and linoleic were significantly decreased in untreated diabetic rats, compared to normal rats.

These results agree to some extent to those reported by **Wang et al., (2003)**, who indicated that

the incidence of diabetes was positively associated with the proportions of palmitic, palmitoleic, and dihomo- $\gamma$ -linolenic acids and inversely associated with the proportion of linoleic acid in plasma cholesteryl esters. While in phospholipids, incident diabetes was positively associated with the proportions of palmitic and stearic acid. Hence authors suggested that the proportional saturated fatty acid composition of plasma is positively associated with the development of diabetes.

Animals treated with **11** revealed normal serum levels of stearic, oleic and linoleic acids, while serum level of  $\gamma$ -linolenic was dramatically reduced by 50% as compared to control diabetic animals. Rats treated with **13** showed non significant alterations in stearic and oleic acids levels while significant reduction was observed in serum level of  $\gamma$ -linolenic acid, in addition to significant elevation in linoleic acid level, compared to CD group. Administration of **1** improved significantly serum fatty acids levels, compared to CD group.

**Laaksonen et al., (2002)** reported that higher proportions of serum non-esterified and esterified linoleic acid were associated with a decreased risk of hyperglycaemia and more favorable changes in fasting insulin and glucose concentrations. Finally, evidence is discussed that FFA represent a crucial link between insulin resistance and beta-cell dysfunction and, as such, a reduction in elevated plasma FFA should be an important therapeutic target in obesity and type 2 diabetes (**Boden and Shulman, 2002**).

Antibiotic resistance is a growing problem, some of this is due to the over use of antibiotics in human, but some of it is probably due to the use of antibiotics as growth promoters in food of animals (**Johnson et al., 2006**). So, there is a growing demand for new antibiotics. Phthalazine derivatives were reported to exhibit interesting antimicrobial activity (**Singh et al., 2010**).

The results of this study showed that compound **10 g** was the most potent phthalazine derivatives against both G +ve and G -ve strains, beside it was potent as chloramphenicol. In addition, compounds **1**, **5**, **7** and **10d** were effective in inhibiting the growth of *Bacillus subtilis*, but less effective than the standard drug. These results agree with those of **Singh et al., (2010)** who reported that phthalazine derivatives exhibited interesting high activity against their reference drugs, and all their tested derivatives exhibited relatively better antibacterial activity against G +ve bacteria, but weak against G -ve bacteria.

The antibacterial activities of tested phthalazines may be related to their ability to affect permeability of the bacterial cell wall through

interacting with the hydroxyl group of the sugar moiety (in peptidoglycan layer) as in case of **10 g** or with amino group of the side chain amino acids as compounds **1**, **5**, **7** and **10 d**. These interactions produce a flux of protons which induces changes in cell membrane and ultimately, cell death. The structural feature may increase the activity of the tested compound since the smaller size can facilitate their penetration through the cell wall. In addition, **10 g** possesses free amino group which is more active than both Cl in **7** and oxygen in compounds **1** and **5**, as well as the long alkyl chain of **10 d**.

The results of anti-bacterial activity of some phthalazine derivatives on Gram -ve bacteria revealed that the effects of derivatives **3**, **5**, **7**, **10d** and **g** were greater than the rest tested compounds on *E. coli*. In regard with *Pseudomonas aeruginosa*, the tested phthalazine derivatives showed mild inhibitory activity as noticed by **1**, **5**, **7**, **10 d** and **10 g**, while the rest compounds had no activity.

Unlike Gram +ve cell wall, the Gram -ve cell wall contains an outer membrane composed by phospholipids and lipopolysaccharides which increase the negative charge of the cell membrane and helps to stabilize the overall membrane structure (Wang and Quinn, 2010). Consequently, compounds **5**, **7**, **10g** and **10d** were the effective compounds against Gram -ve bacteria. Derivative **10d** is considered to be an electron deficient derivative, hence this deficiency may facilitate its penetration through the negative charges surrounding the cell membrane and reacts with the thin peptidoglycan layer to disturb the membrane structure. While the activities of compounds **5**, **7** and **10g** may be related to the polarity on these derivatives. So, this polarity can disturb the electron distribution on the cell membrane. In addition, the antibacterial effects of phthalazines may also be due to their interaction with bacterial enzymes and proteins of the cell membrane.

Although the peptidoglycan layer is thinner in G -ve than Gram +ve bacteria but the effects of the tested compounds were not as potent as in G +ve. This result confirms the suggestion that the main cause of the anti bacterial effect of phthalazine derivatives was due to their interaction with the teichoic acids (not found in G -ve bacteria cell wall), in addition to their effects on the peptidoglycan layer.

## 5. Conclusion

Subchronic treatments of diabetic rats with the tested phthalazine derivatives (3 mg/Kg) have no significant toxic side effects. Compounds **11** and **13** possess potential anti-hyperglycemic activity, while all the tested phthalazine derivatives possess potential antihyperlipidemic activity demonstrated by the

dramatic reduction in serum total lipids, triacylglycerol and most importantly VLDL-C, which is a major carrier of triacylglycerol. Type of chemical derivatization of phthalazine confers glucose and lipid-lowering activities as well as the antibacterial effects.

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## Ocular Findings and Management in Egyptian Children with Down Syndrome

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**Abstract:** Background: Ocular disorders in Down syndrome (DS) are not uncommon. However their frequency in Egyptian population is not well defined. Methods: Ninety Egyptian children with Down syndrome (3 months to 10 years old) were diagnosed both clinically and cytogenetically and followed up for three years. The ophthalmic examination included, evaluation of ocular motility, assessment of eye alignment, using Hirschberg test, portable slit lamp biomicroscopy, cycloplegic retinoscopy, ophthalmoscopy and ultrasound if needed. Results: Fifty two patients (57.8%) with one or more ophthalmological findings were diagnosed in the first visit. Refractive errors (41%) were the most common, with hypermetropia being the most frequent. Strabismus (14.4%) was the next common ocular disorder, followed by nasolacrimal duct obstruction (10%), conjunctivitis and congenital cataract each of them represented (5.6%), blepharoconjunctivitis (4.4%), nystagmus (3.3%) and tilted optic disc (2.2%). However, Brushfield spots were not observed among these patients. There were 12 more ocular disorders detected on follow up. Thirty six patients (40%) had congenital heart defects and 86.1% of them had associated ocular disorders. Conclusions: More than half of patients with Down syndrome had ophthalmic abnormalities. Patients with congenital heart defects had possible association with ophthalmic disorders especially myopia. Ocular examination and management for patients with DS are essential to improve their quality of life.

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**Key words:** Down syndrome, Ocular disorders, Cardiac anomalies, Egypt.

### 1. Introduction:

Down syndrome (MIM, 190685) <sup>(1)</sup> is the most common cause of mental retardation with an incidence of about 1.5/1000 live births. Life expectancy and quality of life have improved substantially for this group over the last few decades <sup>(2)</sup>. Down syndrome was first described by Langdon Down in 1866 <sup>(3)</sup>, who had observed that the eyes of patients were obliquely placed, the internal canthi were more than the normal distance from one another, and the palpebral fissure was very narrow. In addition to the external ocular features, there were other ocular manifestations occurring at higher frequency in individuals with Down syndrome <sup>(4)</sup>. Investigators demonstrated that children with Down syndrome are at risk for developing refractive errors <sup>(5)</sup>, strabismus, nystagmus, and blepharitis. Cataract and glaucoma were less common, but had potentially serious implications for future vision <sup>(6)</sup>.

Normal vision is important for any child. However, if the child is mentally retarded, as individuals with Down syndrome, an additional handicap or sensory impairment may further limit the child's overall functioning and may prevent the child from participating in different learning activities <sup>(7)</sup>.

We aimed to identify the ocular disorders in a pediatric group with Down syndrome and follow them up for three years to determine various ocular and clinical changes. We also evaluated whether these ocular anomalies were associated with cardiac anomalies, or cytogenetic findings.

### 2. Patients and Methods:

A random prospective study included infants and children with DS attending the Clinical Genetics Clinic, in both National Research Centre and Research Institute of Ophthalmology (RIO), during 2006 and 2007, were offered the chance to participate willingly in the study. Inclusion criteria were: clinical examination, required investigations, ophthalmic examination and commitment to regular follow up visits over a period of three years.

Ninety children with Down syndrome were included in the study. They were 47 males and 43 females and their ages ranged between 3 months and 10 years (mean age  $2 \pm 2.1$  years), at the first examination visit. The recruitment and experimental protocols for the study were conducted in compliance with the Declaration of Helsinki, and approved by NRC Ethical Research Committee. Each patient was subjected to complete personal, medical and developmental history taking, family pedigree

construction and analysis with special emphasis on similarly affected family member(s), and meticulous systemic clinical examination to detect any abnormality. The diagnosis of Down syndrome was provisionally based on clinical findings, and confirmed by the G-banding chromosomal analysis. Echocardiography and thyroid profile were done for all patients. Then patients were referred to the Research Institute of Ophthalmology (RIO) for ocular examination by two expert ophthalmologists.

The ophthalmic evaluation included evaluation of ocular motility, portable slit lamp biomicroscopy, cycloplegic retinoscopy, ophthalmoscopy and ultrasound if needed. The presence of nystagmus was noted and eye alignment was assessed using Hirschberg test, and when possible using the prism and cover test. Refraction errors were measured using cycloplegic retinoscopy. Myopia was defined as a refractive error  $-1/5.0$  spherical equivalent, hypermetropia as  $+1.0$  spherical equivalent, and astigmatism as  $> 1.0$  dioptre (D) of cylinder. Uncooperative children were examined under anesthesia.

Patients were followed up by regular clinical and ophthalmic examinations every 3 months. The follow-up period ranged from 31 to 36 months with mean period of  $33 \pm 2.5$  months.

Enrollment in early stimulation/intervention program was offered as a service for the patients, but was not one of the inclusion criteria. Seventy one Down syndrome cases (78.9%) were enrolled in an early stimulation/intervention program using Portage program to improve their developmental milestones. This was performed in the motor-mental skills development unit at the Clinical Genetics Department, National Research Centre.

Statistical analysis was conducted using SPSS program (version 10). Differences in frequency of ophthalmic disorders in different age groups, type of refractive errors in relation to age groups and the frequency of heart defects in Down syndrome children with ocular anomalies were calculated using Chi-Square test. The association of heart defects in Down syndrome children with ocular anomalies was tested using Chi-Square, and Fisher's exact test.

### 3. Results:

At the first examination visit, only two children had a positive family history of Down syndrome and fifty two patients (57.8%) had ophthalmic disorders; some of them had more than one ocular manifestation. Refractive errors (41%) were the most common followed by strabismus, nasolacrimal duct obstruction, conjunctivitis, congenital cataract, blepharoconjunctivitis, nystagmus and tilted optic disc (Table 1). Twelve

other ocular disorders (2 esotropia and 10 conjunctivitis cases) developed in the patients along the course of follow up. Although all patients had hypertelorism, epicanthic folds and upward slanting of palpebral fissures, none of them showed Brushfield spots.

Table (2) showed that most of our patients were 3 months to 5 years old and the percentage of most of ophthalmic disorders significantly increased with age ( $X^2 = 66.94$ ;  $P < 0.001$ ). Table (3) showed that hypermetropia was the most common type of refractive errors. In spite of increasing the percentage of total refractive errors with age, the difference between individual errors was not statistically significant in relation to age ( $X^2 = 0.53$ ;  $P = 0.97$ ).

Table (4) showed congenital heart, cytogenetic and thyroid findings in children with Down syndrome. Thirty six (40%) patients had congenital heart defects (CHD). The most common defects were isolated ASD or VSD. Karyotype analysis revealed non-disjunction trisomy 21 in 85 patients (94.5%). Thyroid profile assessment revealed that most of the patients were normal (94.5%). A total of 31 children (86.1%) out of 36 cases with CHD had associated ocular disorders.

Table 5 shows the frequency of heart defects in children with ocular anomalies. The children with CHD were more likely to have myopia ( $P = 0.027$ ), and were less likely to have astigmatism ( $P = 0.045$ ) using Fisher exact test. No statistical correlation could be detected between ocular anomalies and cytogenetic or thyroid findings, probably due to the small number of cases with translocation or thyroid dysfunction.

### 4. Discussion:

The incidence and severity of ophthalmic disorders varies among individuals with Down syndrome. It is not known why some individuals develop ocular problems and others do not, given that the underlying chromosomal abnormality is almost identical<sup>(8)</sup>. Some authors suggested that the extra chromosomal material causes a generalized disruption in the genetic balance of cells. Accordingly, non-specific developmental instability following aneuploidy may account for ophthalmic anomalies in Down syndrome<sup>(9)</sup>.

In this study 52 Down syndrome cases (57.8%) had ophthalmic abnormalities. Thirty seven cases (41% of all Down syndrome cases) had refractive errors, with hypermetropia being the most frequent, followed by astigmatism then myopia, representing 16.6%, 14.4% and 10% of all cases respectively. The percentage of refractive errors increased with age (Table 3).

**Table (1): Frequency of ophthalmic disorders in children with Down syndrome at the first examination and during follow up visits**

Ophthalmic disorders	Number and % In the first visit	Management	Follow up results
Refractive errors (hypermetropia, astigmatism and myopia)	37 (41% )	- 25 cases were prescribed spectacle correction, - 12 cases just observed for mild refractive error.	- 25 cases with glasses were followed up - 12 cases with no glasses were followed up. - one of 37 patients developed esotropia
Strabismus Esotropia 9 Exotropia 4	13 (14.4%)	- 6 cases (46%) needed glasses - 1 case (8%) required occlusion - 2 cases (15%) required both - 4 (31%) cases had surgical correction of strabismus	- treated cases were improved  -one DS patient developed esotropia.
Nasolacrimal duct obstruction	9 (10%)	massage of the nasolacrimal duct for 2 months maximum	-7 cases improved with digital massage - 2 cases were treated by probing
Conjunctivitis	5 (5.6%)	- treated with antibiotic eye drops - swabs were taken from resistant cases for culture	- all 5 cases improved with treatment & conjunctivitis resolved - 10 cases had conjunctivitis during follow up visits & were similarly treated
Congenital cataract	5 (5.6%)	cataract extraction and implantation of intraocular lens	- improved visual functions
Blepharoconjunctivitis	4 (4.4%)	sodium bicarbonate 3% lotion & antibiotic eye drops	- improved
Nystagmus	3 (3.3%)	1 case had associated congenital cataract.	- case improved after cataract extraction and intraocular lens implantation -the other 2 cases had congenital heart & were unfit for examination under anesthesia
Tilted optic disc	2 (2.2%)	- associated astigmatism was corrected by eye glasses	- improved visual functions

**Table (2): Ophthalmic disorders in different age groups during follow up**

Ophthalmic disorders	1 year n=35	1-5 years n= 46	5-10 years n = 9
Refractive errors	10 (28.6%)	21 (45.7%)	6 (66.7%)
Strabismus	4(11.4%)	7 (15.2%)	4 (44.4%)
Nasolacrimal duct obstruction	6 (17.1%)	3 (6.5%)	0 .0
Conjunctivitis	4 (11.4%)	7(15.2%)	4(44.4%)
Cataract	0.0	4(8.7%)	1 (11.1%)
Blepharoconjunctivitis	1 (2.9%)	2(4.3%)	1 (11.1%)
Nystagmus	1 (2.9%)	2 (4.3%)	0.0
Tilted optic disc	1(2.9%)	0.0	1 (11.1%)

**Table (3): Type of refractive errors in age groups of children with Down syndrome**

Age (years) and patients number	Hypermetropia (sphere range in diopters)	Myopia (sphere range in diopters)	Astigmatism (sphere range in diopters)	Total (%)
1 year n =35	6 (3.0-4.5 D)	2 (5.0 D)	2 (1-4 D)	10 (28.6)
1-5 years n =46	8 (3.0-6.0 D)	5 (2.0 – 20 D)	8 (1-2 D)	21 (45.7)
5- 10 years n =9	1 (3.0 D)	2 (5.0 – 8.0 D)	3 (2-6.8 D)	6 (66.7)
Total n =90 (%)	15 (16.6)	9 (10)	13 (14.4)	37 (41)

**Table (4): Frequency of congenital heart defects (CHD), cytogenetic and thyroid findings in children with Down syndrome**

Findings	n(%)
<b>Type of congenital heart disease</b>	
Atrial septal defect (ASD)	8 (8.9%)
Ventricular septal defect (VSD)	8 (8.9%)
Patent foramen ovale (PFO)	3 (3.3%)
Atrio-Ventricular canal (A-V canal)	2 (2.2%)
ASD + Patent ductus arteriosus (PDA)	4 (4.4%)
ASD +VSD	3 (3.3%)
Other combinations of CHD	8 (8.9%)
Total patients with CHD	36 (40%)
without CHD	54 (60%)
<b>Cytogenetic findings</b>	
Non-disjunction trisomy 21	85 (94.5%)
Translocations trisomy 21	4 (4.5%)
Mosaic trisomy 21	1 (1%)
<b>Thyroid profile</b>	
Normal	85 (94.5%)
Hypothyroidism	3 (3.3%)
Hyperthyroidism	2 (2.2%)

**Table (5): Frequency of heart defects in Down syndrome children with ocular anomalies**

Ocular anomaly	Heart defects		Total
	Yes	No	
<b>Refractive errors</b>	15 (40.5%)	22 (59.5%)	37
Hypermetropia	6 (40.0%)	9 (60.0%)	15
Myopia	* 7 (77.8%)	2 (22.2%)	9
Astigmatism	2 (15.4%)	*11 (84.6%)	13
<b>Strabismus</b>	5 (33.3%)	10 (66.7%)	15
<b>Nasolacrimal duct obstruction</b>	4 (44.4%)	5 (55.6%)	9
<b>Conjunctivitis</b>	5 (33.3%)	10 (66.7%)	15
<b>Congenital cataract</b>	2 (40.0%)	3 (60.0%)	5
<b>Nystagmus</b>	2 (66.7%)	1 (33.3%)	3

\*  $P \leq 0.05$  is significant

Previous studies reported that refractive errors, especially hypermetropia, were the most frequent ophthalmic anomaly among young patients with Down syndrome. Stephen et al. <sup>(10)</sup>, studied ocular disorders in 81 children with Down syndrome at school age, where they documented refractive errors in 43% of cases, with hypermetropia as the most frequent disorder (27%). Another study by Fimiani et al. <sup>(11)</sup> identified the incidence of primary ocular pathologies among 157 Italian children with Down syndrome (1 month to 18 years old) as follows: hypermetropia 59% of patients, astigmatism

28% and myopia 9%. Analysis of our data revealed that the refraction errors did not improve with age. Similarly, Stephen et al. <sup>(10)</sup> reported an increase of refractive errors with age in Down syndrome patients. This finding is in contrast to healthy developing children, who become more emmetropic with age.

The prevalence of strabismus among the individuals with Down syndrome at the first visit was 14.4%, (another 2 cases developed esotropia during follow up, and accordingly the percentage reached 16.6%). A study conducted in Nigeria <sup>(12)</sup> reported



similar results (18.1%). Other studies in Malaysia and United Kingdom documented higher incidence of strabismus among DS patients, presenting 26.7% and 47%, respectively<sup>(10; 13)</sup>. However, the patients' age groups of these two studies were older than our cases. It has also been documented that the incidence of strabismus among general population ranged from 1-5%<sup>(14)</sup>, which is much lower than the that reported by various studies among children with Down syndrome<sup>(10; 12; 13)</sup>, including our study. Esotropia was more common (12.2%) than exotropia (4.4%) among our cases. Merrick and Koslowe<sup>(15)</sup> found that the majority of Down syndrome children with strabismus had an acquired esotropia. They also suggested that hypermetropia and accommodation weakness were important factors of esotropia in Down syndrome patients.

Nasolacrimal duct (NLD) obstruction was diagnosed in 10% of cases (9 patients), and was more common in younger children (3-12 months, 17.1%) than in older age groups (6.5% and 0% respectively). In the current study, lacrimation problem improved by time with regular digital massaging technique in 7 patients, while 2 cases needed probing of the NLD. Nasolacrimal outflow obstruction is common and is believed to be a difficult problem to treat in Down syndrome patients<sup>(16)</sup>. Some studies have suggested that simple nasolacrimal duct (NLD) probing can be an effective primary surgery for congenital NLD obstruction and age does not appear to have an impact on success of probing<sup>(13; 17)</sup>.

At the first visit, 5 Down syndrome cases had conjunctivitis, and 4 had blepharoconjunctivitis. Another 10 patients developed conjunctivitis during follow up. Conjunctivitis was treated by antibiotic eye drops, and swabs were taken from resistant cases for culture and sensitivity. Patients with blepharoconjunctivitis were given sodium bicarbonate 3% lotion and antibiotic eye drops. Previous studies indicated that Down syndrome is associated with disturbance of tear function and impaired immunity. These anomalies could be responsible for the frequent infectious pathologies found in the anterior eye segment<sup>(18; 19)</sup>.

The frequency of congenital cataract in this study was 5.6 %, which was more or less similar to other publications<sup>(10; 12)</sup>. Most of our cases were 1- 5 years old, except one case, which developed cataract at the age of 9 years. Some authors reported that cataract was more common in Down syndrome children above the age of 12 years<sup>(20)</sup>. Early detection and management is essential to prevent amblyopia<sup>(21)</sup>.

In this study three children had nystagmus (3.3% of patients) and one of them was diagnosed as congenital cataract with nystagmus. The other two patients had complicated congenital

heart disease and were unfit for examination under anesthesia. Wagner et al.<sup>(22)</sup> observed that nystagmus in Down syndrome patients, was not always associated with significant decrease in visual acuity and not indicative of severe ocular abnormalities.

Fundusoscopic examination showed tilted optic disc in two Down syndrome patients with astigmatism. Vongphanit et al.<sup>(23)</sup> documented that a tilted disc appearance was strongly associated with astigmatism and higher levels of spherical refractive error, particularly myopia. No notable Brushfield spots were detected in our Egyptian patients. This finding was reported before in an Asian study, although most Caucasian studies reported Brushfield spots in children with Down syndrome<sup>(24)</sup>. A study of a larger Egyptian sample of Down syndrome patients is needed to establish the significance of this finding.

Congenital heart diseases were diagnosed in (40%) of patients. A previous Egyptian study of another 23 Down syndrome cases reported a nearly similar percentage of congenital heart defects (39.1%)<sup>(25)</sup>. Published molecular studies suggested that the 21q22.1-q22.3 region, or Down syndrome critical region (DSCR), might contain the genes responsible for the congenital heart disease<sup>(5, 26)</sup>.

In this study, congenital heart defects were significantly associated with myopia ( $P = 0.027$ ), while astigmatism was associated with absence of congenital heart defects in children with Down syndrome ( $P = 0.045$ ). Bromham et al.<sup>(8)</sup> found that Down syndrome children with heart defects were associated with both myopia and nystagmus. Davies *et al.*<sup>(27)</sup> reported an association between variation in the COL6A1 gene region and congenital heart defects in Down syndrome. COL6A1 codes for a part of collagen VI, a component of many ocular tissues<sup>(28)</sup>. Down syndrome cell adhesion molecule (DSCAM) has also been considered as a candidate gene for heart and visual pathway defects in Down syndrome<sup>(29)</sup>. These findings may explain the association between some ocular disorders and congenital heart defects in Down syndrome patients. The interesting finding of negative association between CHD and astigmatism needs further study.

Karyotype analysis revealed that 94.5% of patients had non-disjunction trisomy 21 and 4.5% of them had translocations. This result agrees with previous cytogenetic investigations carried out on 1021 Indian cases of Down syndrome<sup>(30)</sup>. Also, thyroid profile assessment revealed that most of the patients were normal (94.5%), while three patients had hypothyroidism, and two had hyperthyroidism. Similar results have been previously documented with Down syndrome<sup>(31)</sup>. Murphy *et al.*<sup>(32)</sup>, documented that thyroid dysfunction was detected in 4.6% of children with Down syndrome screened for

hypothyroidism by capillary whole blood TSH sample.

In conclusion, young Egyptian patients with Down syndrome demonstrated a high frequency of ophthalmic disorders, and no notable Brushfield spots. Follow up of Down syndrome children showed that refractive errors do not improve with age, and the percentage of ophthalmic disorders as strabismus increased. There was a variable association between congenital heart defects and ophthalmic disorders. Therefore, we suggest implementation of an ophthalmic program for Down syndrome individuals, which necessitates a regular check-up of patients every 3 months, starting since birth. Such a program will lead to early diagnosis and treatment of ocular conditions in patients with Down syndrome to alleviate future health problems. The overall aim for patients with Down syndrome should be to improve their quality of life, not just their life expectancy.

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## Dual Construction of Developable Ruled Surface

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**Abstract:** In this paper, some of developable ruled surfaces are constructed using the dual representation of plane curves through a dual unit space curve on the dual unite sphere. These surfaces are studied and plotted.

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### 1. Introduction:

Dual numbers were introduced in the 19th century by Clifford, and there application to rigid body kinematics was subsequently generalized by Kafelnikov and study in their principle of transference. The principle of transference states that if dual numbers replace real ones then all relations of vector algebra for intersecting lines are also valid for skew lines. In practice, this means that all rules of vector algebra for the kinematics of a rigid body with a fixed point (spherical kinematics) also hold for motor algebra of a free rigid body (spatial kinematics). As a result, a general rigid body motion can be described by only three dual equation rather than six real ones. For several decades there were attempts to apply dual numbers to rigid body dynamics. Investigators showed that the momentum of a rigid body can be described as a motor that obeys the motor transformation rule; hence, its derivative with respect to time yields the dual force. However in those investigations, while going from the velocity motor to the momentum motor, there was always a need to expand the equation to six dimension and to treat the velocity motor as two separate real vectors. This process actually diminishes one of the main advantages of dual numbers namely, compactness of representation. Screws in the space can be represented by dual vectors at the origin. The components of a dual vector consisting of a line vector at the origin and the perpendicular moment vector for the line vector in the space are equal to Plücker's line coordinates. Furthermore the space of lines could be represented by points on the unit sphere and points in the tangential planes affiliated to each point on the sphere [3].

#### 1.1 Dual Numbers [2],[3],[4]

A dual number  $\hat{x}$  is defined as an ordered pair of real numbers  $(x, x^*)$  expressed formally as

$$\hat{x} = x + \varepsilon x^* \quad (1.1)$$

where  $x$  is referred to as the real part and  $x^*$  as the dual part of The symbol  $\varepsilon$  is a multiplier which has the property  $\varepsilon^2 = 0$ . The algebra of dual numbers results from (1.1). Two dual numbers are equal if and only if their real and dual parts are equal, respectively. As in the case of complex numbers, addition of two dual numbers is defined as

$$(x + \varepsilon x^*) + (y + \varepsilon y^*) = (x + y) + \varepsilon(x^* + y^*) \quad (1.2)$$

Multiplication of two dual numbers result in:

$$(x + \varepsilon x^*)(y + \varepsilon y^*) = xy + \varepsilon(x^*y + xy^*) \quad (1.3)$$

Division of dual numbers  $\frac{\hat{x}}{\hat{y}}$  is defined as

$$\frac{\hat{x}}{\hat{y}} = \frac{x}{y} + \varepsilon\left(\frac{x^*}{y} - \frac{xy^*}{y^2}\right), y \neq 0 \quad (1.4)$$

Remark that: division is possible and unambiguous only if  $y \neq 0$ .

#### 1.2 Dual function

Dual function of dual number presents a mapping of a space of dual numbers on itself, namely.

$$\hat{f}(\hat{x}) = f(x, x^*) + \varepsilon f^*(x, x^*) \quad (1.5)$$

where  $\hat{x} = x + \varepsilon x^*$  is a dual variable,  $f$  and  $f^*$  are two, generally different, functions of two variables. The dual function (1.5) is said to be analytic if it satisfies the following

$$\hat{f}(x + \varepsilon x^*) = f + \varepsilon f' = f(x) + \varepsilon(x^* f'(x) + \tilde{f}(x)), \quad ' = \frac{d}{dx} \quad (1.6)$$

where  $\tilde{f}(x)$  is an arbitrary function of a real part of a dual variable. The analytic condition for dual function is

$$\frac{\partial f^*}{\partial x^*} = \frac{\partial f}{\partial x} \quad (1.7)$$

The derivative of such a dual function with respect to a dual variable is

$$\frac{d\hat{f}(\hat{x})}{d\hat{x}} = \frac{\partial f^*}{\partial x^*} + \varepsilon \frac{\partial f^*}{\partial x} \quad (1.8)$$

Taking into account (1.7) we have:

$$\frac{d\hat{f}(\hat{x})}{d\hat{x}} = \frac{\partial f}{\partial x} + \varepsilon \frac{\partial f^*}{\partial x} = f'(x) + \varepsilon(x^* f''(x) + \tilde{f}'(x)) \quad (1.9)$$

If a function  $f(x)$  has the derivative  $f'(x)$ , its value for the dual argument  $\hat{x} = x + \varepsilon x^*$  is denoted by  $\hat{f}(\hat{x})$  or  $\hat{f}(x)$ . Using the formal Taylor expansion of the function  $\hat{f}(x)$  with the property  $\varepsilon^2 = 0$ ; we have

$$\hat{f}(x) = f(x + \varepsilon x^*) = f(x) + \varepsilon x^* f'(x) \quad (1.10)$$

### 1.3 Dual space

The set

$$D^3 = D \times D \times D = \{\hat{x} : \hat{x} = (x_1 + \varepsilon x_1^*, x_2 + \varepsilon x_2^*, x_3 + \varepsilon x_3^*) \\ = (x_1, x_2, x_3) + \varepsilon(x_1^*, x_2^*, x_3^*) = \underline{x} + \varepsilon \underline{x}^*, \underline{x}, \underline{x}^* \in R^3\}$$

is a module on the ring  $D$  and is called the dual space (vector space defined on the field of dual numbers).

For any  $\hat{x} = \underline{x} + \varepsilon \underline{x}^*$ ,  $\hat{y} = \underline{y} + \varepsilon \underline{y}^*$ , the scalar or inner product and the vector product  $\pi_{\hat{x}, \hat{y}} \phi$ ,  $\hat{x} \wedge \hat{y}$  of  $\hat{x}$  and  $\hat{y}$  by are defined by, respectively

$$\langle \hat{x}, \hat{y} \rangle = \langle \underline{x}, \underline{y} \rangle + \varepsilon (\langle \underline{x}, \underline{y}^* \rangle + \langle \underline{x}^*, \underline{y} \rangle) \quad (1.11)$$

$$\hat{x} \wedge \hat{y} = (\underline{x}_2 \underline{y}_3 - \underline{x}_3 \underline{y}_2, \underline{x}_3 \underline{y}_1 - \underline{x}_1 \underline{y}_3, \underline{x}_1 \underline{y}_2 - \underline{x}_2 \underline{y}_1) \quad (1.12)$$

Where

$$\hat{x} = (x_i + \varepsilon x_i^*), \hat{y} = (y_i + \varepsilon y_i^*) \in D^3, 1 \leq i \leq 3$$

If  $\underline{x} \neq 0$ , The norm  $\|\hat{x}\|$  of is defined by

$$\|\hat{x}\| = \sqrt{\langle \hat{x}, \hat{x} \rangle} = \|\underline{x}\| + \varepsilon \frac{\langle \underline{x}, \underline{x}^* \rangle}{\|\underline{x}\|} \quad (1.13)$$

A dual vector  $\hat{x} = \underline{x} + \varepsilon \underline{x}^*$  is a dual unit vector if it satisfies the following  $\pi_{\underline{x}, \underline{x}^*} \phi = 0$  and  $\pi_{\underline{x}, \underline{x}} \phi = 1$ . Then we have that  $\pi_{\hat{x}, \hat{x}} \phi = 1$ .

Then a dual vector  $\hat{x}$  with unit norm is called

a dual unit vector. The subset

$$S^2 = \{\hat{x} = \underline{x} + \varepsilon \underline{x}^* : \|\hat{x}\| = (1, 0); \underline{x}, \underline{x}^* \in R^3\} \subset D^3$$

is called the dual unit sphere with the center  $\hat{O}$  in  $D^3$ .

### 1.4 Dual space curve

If every  $x_i(u)$  and  $x_i^*(u)$ ,  $1 \leq i \leq n$  and  $u \in R^n$ , are differentiable dual valued functions, the dual vector field  $\hat{x}(u)$  is defined as the following  $\hat{x} : u \subset R^n \rightarrow D^n$ ,  $\hat{x}(u) = x(u) + \varepsilon x^*(u)$ .

Dual space curve is a dual vector field of one variable defined as the following  $\hat{x} : I \subset R \rightarrow D^3$ , where

$$u \rightarrow \hat{x}(u) = (x_1(u) + \varepsilon x_1^*(u), x_2(u) + \varepsilon x_2^*(u), x_3(u) + \varepsilon x_3^*(u)) = x + \varepsilon x^* \in D^3$$

is differentiable. The real part  $\underline{x}(u)$  is called the indicatrix of the space curve  $\hat{x}(u)$ . The dual arc length of the curve  $\hat{x}(u)$  from  $u_1$  to  $u$  is defined as

$$\int_{u_1}^u \|\hat{x}'(u)\| du = \int_{u_1}^u \|\underline{x}'(u)\| du + \varepsilon \int_{u_1}^u \pi_{\underline{T}, \underline{x}^*}(u)' \phi du = s + \varepsilon s^*$$

where  $\underline{T}$  is a unit tangent vector of  $\underline{x}(u)$ . From now on we will take the arc length  $s$  of  $\underline{x}(u)$  as the parameter instead of  $u$ .

### Dual Developable Ruled surface

Consider a dual unit space curve which is given by the following equation

$$\hat{x}(u^1) = \hat{x}(u^1, \varepsilon) = x(u^1) + \varepsilon x^*(u^1) \quad (2.1)$$

then we have the following

$$\langle \underline{x}, \underline{x} \rangle = 1, \langle \underline{x}, \underline{x}^* \rangle = 0, \langle \underline{x}^*, \underline{x}^* \rangle = 0, \langle \underline{x}^*, \underline{x}' \rangle = 0 \quad (2.2)$$

From these relations, we have  $x^* \times x' = 0$ .

$$\sigma : R(u^a) = R(u^1, u^2) = x(u^1) \times x^*(u^1) + u^2 x(u^1) \quad (2.3)$$

Consider a ruled surface defined by the vector equation

The tangent vectors to the surface  $\sigma$  are given as



$$R_1 = x \times x' + u^2 x', \quad R_2 = x, \quad R_3 = \frac{\partial R}{\partial u}, \quad ' = \frac{d}{du} \quad (2.4)$$

Then the coefficients of the first fundamental form are given as

$$g_{11} = \langle R_1, R_1 \rangle = \|x \times x' + u^2 x'\|^2 + u^2 x' \cdot (x \times x') + (u^2)^2 \|x'\|^2 \quad (2.5)$$

$$g_{12} = \langle R_1, R_2 \rangle = 0, \quad g_{22} = \langle R_2, R_2 \rangle = 1 \quad (2.6)$$

Thus the normal vector field is defined as

$$N = \frac{R_1 \times R_2}{g} = \frac{\langle x' \times x \rangle + x \times x' + u^2 (x' \times x)}{g}, \quad g = \det(g_{\alpha\beta}) \quad (2.7)$$

Also the 2nd derivatives are

$$R_{11} = x' \times x' + x \times x'' + u^2 x'', \quad R_{12} = x', \quad R_{22} = 0 \quad (2.8)$$

Then the coefficients of the second fundamental forms are defined as

$$L_{22} = \langle N, R_{22} \rangle = 0, \quad L_{12} = 0 \quad (2.9)$$

The Gaussian curvature given from the following equation

$$K = \frac{L_{22}L_{11} - L_{12}^2}{g} \quad (2.10)$$

Thus from (2.9) we have  $K = 0$  and the ruled surface (2.3) is a type of developable ruled surface [8].

### Spherical Image of plane Curve

Here we gave a general method to construct the spherical image of a plane curve. There for we consider plane curve  $C: \underline{X} = (x(u^1), y(u^1)) \subset R^2$  and a unite sphere  $S^2$  given as  $S^2: x^2 + y^2 + (z-1)^2 = 1$ . Let  $(a, b, 0)$  be any point on the plane curve  $C$ . Hence we may write the straight line passing through the north pole  $(0, 0, 2)$  of the sphere  $S^2$  and  $(a, b, 0)$  by the normal equations

$$\ell: \frac{x}{a} = \frac{y}{b} = \frac{2-z}{2} \quad (3.1)$$

Let  $(\alpha, \beta, \gamma) \in S^2$  be the point of intersection of the line  $\ell$  and the unite sphere  $S^2$  without the north pole point  $(0, 0, 2) \in S^2$ . For this point, the equation (3.1) becomes

$$\frac{\alpha}{a} = \frac{\beta}{b} = \frac{2-\gamma}{2} \quad (3.2)$$

Then we have

$$a = \frac{2\alpha}{2-\gamma}, \quad b = \frac{2\beta}{2-\gamma} \quad (3.3)$$

And from the equation of the sphere  $S^2$ , it is easy to see that

$$\alpha = \frac{4a}{a^2+b^2+4}, \quad \beta = \frac{4b}{a^2+b^2+4}, \quad \gamma = \frac{4a}{a^2+b^2+4} \quad (3.4)$$

Thus we have one to one correspondence  $C \subset R^2 \rightarrow \zeta = (\alpha, \beta, \gamma) \subset S^2 \subset R^3$ . The

curve  $\zeta = (\alpha, \beta, \gamma)$  is called the spherical image of the plane curve  $C$  and this correspondence is called stereographic projection [1],[2]. For the spherical curve  $\zeta = (\alpha, \beta, \gamma)$ , its possible to obtain a space curve

$$r = r(u^1) = (\alpha, \beta, \eta) = (x_1, x_2, x_3), \quad \eta = \gamma - 1 \quad (3.5)$$

parameterized by an arc length (unit speed curve) which has the same trace as  $\zeta$ . In fact let

$$s = s(u^1) = \int_0^{u^1} \|\zeta'(u^1)\| du^1, \quad u^1 \in \text{the domain of}$$

the curve  $\zeta$ . Since  $\frac{ds}{du^1} = \|\zeta'(u^1)\| \neq 0$ , the

function  $s = s(u^1)$  has a differentiable inverse function  $s^{-1}$  of  $s$ . Now set  $r = \zeta(u^1)$ .  $u^1$  and

Clearly, we have  $\|r'(s)\| = \|\zeta'(u^1)\| \cdot \left| \frac{du^1}{ds} \right| = 1$ . This

show that  $r$  has the same trace as  $\zeta$  and is parameterized by arc length. It is usual to say that  $r$  is a parameterizations of  $\zeta$  by arc length. This fact allows us to extend all local concepts defined to the curve  $\zeta$ . Thus, we say that the curvature  $k(u^1)$  of  $\zeta$  at  $u^1$  is the curvature of the parameterized curve  $r$  of  $\zeta$  by arc length  $s = s(u^1)$  at the corresponding point. This is clearly independent of the choice of  $r$ , it is often convenient to use  $u^1$  as a parameter instead of  $s$  in the reparameterized curve  $r$ .

Let  $r(u^1)$  be the arc length reparameterization of  $\zeta(u^1) = (\alpha, \beta, \gamma)$ . Then, we may construct the dual curve  $\hat{r} = r(u^1, \varepsilon) = r(u^1) + \varepsilon r^*(u^1)$  corresponding to the curve  $r = r(u^1)$ . Firstly, the dual part  $r^*(u^1)$  of the dual curve is given from

$$r^*(u^1) = r(u^1) \times ON = (x_1, x_2, x_3) \times (0, 0, 1) = (-x_2, x_1, 0) \quad (3.6)$$

where  $O$  is the center of the sphere  $S^2$  and  $N$  is the north pole. Then, the dual curve can be written in the following representation

$$\hat{r}(u^1) = r(u^1, \varepsilon) = (x_1, x_2, x_3) + \varepsilon(-x_2, x_1, 0) \quad (3.7)$$

Where  $\varepsilon^2 = 0$  and  $\hat{r} = r(u, \varepsilon)$  is a dual unite spherical curve corresponding to the plane curve C.

### Construction of developable ruled surfaces

Here we construct a developable ruled surface corresponding to the dual unit space curve on  $S^2$  which corresponding to a plane curve. This ruled surface is given by

$$R(u^1, u^2) = r(u^1) \times r^*(u^1) + u^2 r(u^1) \quad (4.1)$$

where  $r(u^1)$  and  $r^*(u^1)$  are given by (3.5) and (3.6) respectively. In what follows, we construct developable ruled surfaces corresponding to plane curve of type Hypotrochoid, rose, ellipse, circle and catena

### Dual developable ruled rose surfaces

Consider the Hypotrochoid curve given by

$$hy(u^1; n, m, c_1, c_2) = (x(u^1), y(u^1)) \subset C^2$$

where

$$x(u^1) = (n - m) \cos(u^1 + \alpha) + c_1 m \cos\left(\frac{(n-m)u^1}{m} - c_2\right) \quad (4.2)$$

$$y(u^1) = (n - m) \sin(u^1 + \alpha) - c_1 m \sin\left(\frac{(n-m)u^1}{m} - c_2\right)$$

Using the spherical representation in section(3) we have its corresponding dual curve and the constructed ruled surface in this case is called developable Hypotrochoid ruled surface. If we consider  $n = 3, m = 1, c_1 = 2, c_2 = 0$  and using equation (4.2) its easy to see that

$$hy(u^1; 3, 1, 2, 0) = (2 \cos u^1 + 2 \cos 2u^1, 2 \sin u^1 - 2 \sin 2u^1)$$

Then from (3.4) its easy to verify that the spherical image of this curve is given by

$$\zeta = (\alpha, \beta, \gamma) = M(2(\cos u^1 + \cos 2u^1), 2(\sin u^1 - \sin 2u^1), 4 + 4 \cos 3u^1) \quad (4.3)$$

where  $M(3 + 2 \cos 3u^1) = 1$

Then we have the arc length reparamerization  $r(u^1)$  of  $\zeta(u^1)$  as the following

$$r(u^1) = M(2(\cos u^1 + \cos 2u^1), 2(\sin u^1 - \sin 2u^1), 1 + 2 \cos 3u^1) \quad (4.4)$$

Thus the dual part of the dual curve is

$$r^*(u^1) = r(u^1) \times (0, 0, 1) = M(-2(\sin u^1 - \sin 2u^1), 2(\cos u^1 + \cos 2u^1), 0) \quad (4.5)$$

and the dual unit spherical curve is given as

$$\hat{r}(u^1) = r^*(u^1) + \varepsilon r(u^1) \quad (4.6)$$

Then the developable ruled surface corresponding to this curve is defined as

$$R(u^1, u^2) = r(u^1) \times r^*(u^1) + u^2 r(u^1) \quad (4.7)$$

where

$$r(u^1) \times r^*(u^1) = M^2(M_1 M_2, M_2 M_3, M_1^2 + M_2^2) \quad (4.8)$$

where

$$\begin{aligned} M_1 &= 2(\cos u^1 + \cos 2u^1), M_2 = \sin u^1 - \sin 2u^1 \\ M_3 &= 1 + 2 \cos 3u^1 \end{aligned} \quad (4.9)$$

The ruled surface defined by (4.4), (4.7) and (4.8) is called a developable ruled rose surface as shown in Fig.1,

### Developable ruled ellipse surfaces

Consider the ellipse curve  $C : (a \cos u^1, b \sin u^1, 0)$  and using the spherical representation (3.4) we have.

where  $v(5 + \cos u^1) = 1$ .

Then the dual spherical image  $\hat{r}(u^1) = r(u^1) + \varepsilon r^*(u^1)$  of the ellipse

( $a = \sqrt{2}, b = 1$ ) on  $S^2$  is given from

$$r(u^1) = v(4\sqrt{2} \cos u^1, 4 \sin u^1, -3 + \cos^2 u^1) \quad (4.11)$$

and its dual part is

$$r^*(u^1) = v(-4 \sin u^1, 4\sqrt{2} \cos u^1, 0) \quad (4.12)$$

Thus, we have a developable ruled surface given by

$$R(u^1, u^2) = r(u^1) \times r^*(u^1) + u^2 r(u^1) \quad (4.13)$$

where

$$r(u^1) \times r^*(u^1) = v^2(4\sqrt{2} \cos u^1(-3 + \cos^2 u^1), 4 \sin u^1(-3 + \cos^2 u^1), 16 + 16 \cos^2 u^1) \quad (4.14)$$

This surface is called developable ruled ellipse surface as shown in Fig 2.

### Developable ruled circle surfaces

Consider the unit circle curve  $S : (\cos u^1, \sin u^1, 0)$  and using the same derivations as in the previous case we have the spherical image of the circle as in the following.

$$\zeta = \frac{4}{5}(\cos u^1, \sin u^1, 1) \quad (4.15)$$

Also the dual part  $r^*(u^1)$  of the dual unite spherical curve  $\hat{r}(u^1) = r(u^1) + \varepsilon r^*(u^1)$  is given by

$$r^*(u^1) = \frac{4}{5}(-\sin u^1, \cos u^1, 0) \quad (4.17)$$

Thus the corresponding developable ruled ellipse surface is given in the form

$$R(u^1, u^2) = r(u^1) \times r^*(u^1) + u^2 r(u^1) \quad (4.18)$$

where

$$r(u^1) \times r^*(u^1) = \frac{4}{25}(\cos u^1, -\sin u^1, 4) \quad (4.19)$$

This ruled surface plotted in Fig.3 and is called developable circle ruled surface

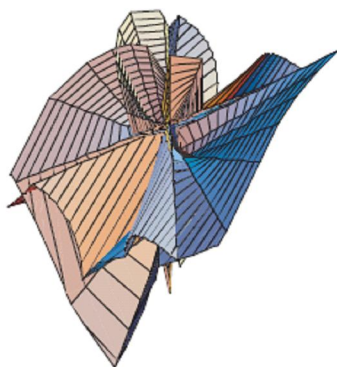


Figure 1: The developable ruled rose surface

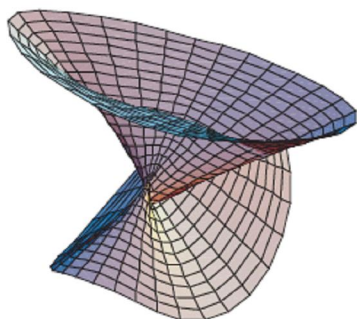


Figure 2: The developable ruled ellipse surface

### Developable ruled catena surfaces

Consider the catena curve  $C : (a \cosh \frac{u^1}{a}, u^1, 0)$

and using the same derivations as in the previous case we have the spherical image of the catena. The spherical image of the catena is given by (a=1)

$$\zeta = \eta(4 \cosh u^1, u^1, 2(\cosh^2 u^1 + (u^1)^2)) \quad (4.20)$$

where  $\eta(\cosh^2 u^1 + (u^1)^2 + 4) = 1$  and its unite parameterized curve is

$$r(u^1) = \eta(4 \cosh u^1, u^1, \cosh^2 u^1 + (u^1)^2 - 4) \quad (4.21)$$

Also the dual part  $r^*(u^1)$  of the dual unite spherical curve  $\hat{r}(u^1) = r(u^1) + \varepsilon r^*(u^1)$  is

$$r^*(u^1) = \eta(-u^1, 4 \cosh u^1, 0) \quad (4.22)$$

Then the developable ruled surface is represented by

$$R(u^1, u^2) = r(u^1) \times r^*(u^1) + u^2 r(u^1) \quad (4.23)$$

where

$$r(u^1) \times r^*(u^1) = \eta^2(4 \cosh u^1 (\cosh^2 u^1 + (u^1)^2 - 4), u^1 (\cosh^2 u^1 + (u^1)^2 - 4), 16 \cosh^2 u^1 + (u^1)^2) \quad (4.24)$$

This ruled surface plotted in Fig4 and is called developable catena. ruled surface

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## Extractive Spectrophotometric Determination of some Drugs Through Ion-Pair Complex Formation with Thiocyanate and Cobalt (II) or Molybdenum (V)

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**Abstract:** Two rapid, simple and sensitive extractive spectrophotometric methods have been developed for the assay of Hyoscine butyl bromide (HBB), losartan potassium (LSR) and Sertaline HCl (SER) in bulk and in their pharmaceutical formulations. The proposed methods depend upon the reaction of cobalt(II)–thiocyanate (method A) and molybdenum(V)–thiocyanate ions (method B) with the cited drugs to form stable ion-pair complexes which are extractable with an n-butanol–dichloromethane solvent mixture (3.5:6.5) and methylene chloride for methods A and B, respectively. The blue and orange red color complexes are determined either colorimetrically at  $\lambda_{\max}$  625, 627 and 630 nm for HBB, SER and LSR respectively (using method A) and 478, 465 and 468 nm for HBB, SER and LSR respectively (using method B). The concentration range is 20–400 and 5–50  $\mu\text{g mL}^{-1}$  for methods A and B, respectively. The proposed method was successfully applied for the determination of the studied drugs in pure and pharmaceutical formulations applying the standard additions technique and the results obtained were in good agreement with those obtained by the official method.

[Ragaa El-Shiekh, Magda Akl, Ayman Gouda and Wael Ali. **Extractive Spectrophotometric Determination of some Drugs Through Ion-Pair Complex Formation with Thiocyanate and Cobalt (II) or Molybdenum (V)**. Journal of American Science 2011;7(4):794-807]. (ISSN: 1545-1003). <http://www.americanscience.org>.

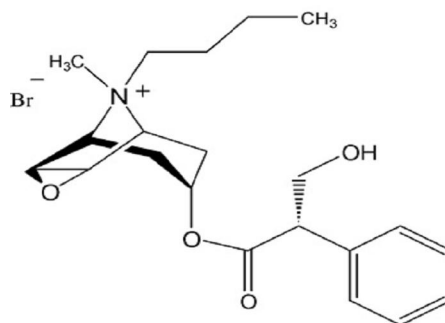
**Keywords:** Hyoscine butyl bromide; losartan potassium; Sertaline HCl; Ion-pair complexes; Spectrophotometry; Pharmaceutical formulations

### 1. Introduction:

**Hyoscine butylbromide (HBB)**, (1S, 3s, 5R, 7S, 8r)-6,7-epoxy-3-[(S)-(3-hydroxy-2-phenylpropionyloxy)-8-butyl-8-methyl-8-azoniabicyclo[3.2.1]octane bromide is used as an antispasmodic in treating peptic ulcer, gastritis and various disorders of the gastrointestinal tract which are characterized by spasm. (Structure 1) It has also been found an employment for the relief of spasmodic conditions of the bile duct and urinary tract and for the treatment of dysmenorrhoea [10]. Famciclovir (FCV) is an antiviral drug and is chemically [2-(acetyloxymethyl)-4-(2-aminopurin-9-yl)-butyl] acetate. **HBB** has been determined in pharmaceutical preparations including titrimetric methods spectrophotometric [11,12], high-performance liquid chromatographic [13], capillary electrophoresis [14,15] and electrochemical methods [16].

**Losartan potassium (LSR)**, 2-butyl-4-chloro-1-[[2-(1H-tetrazol-5-yl)[1,1'-biphenyl]-4-yl]methyl]-1H-imidazole-5-methanol monopotassium salt, is the first member of a new class of nonpeptide angiotensin II receptor antagonist (Structure 2). It acts effectively at its receptors, thereby blocking the rennin-angiotensin system. [17,18] several analytical procedures have been reported for the determination of losartan potassium products in tablets, individually

or in combination with other drugs; these include flow injection [19], high performance liquid chromatography (HPLC) [20,21,22], capillary zone electrophoresis [23], spectrophotometry [24–26], and electrochemical techniques [25].



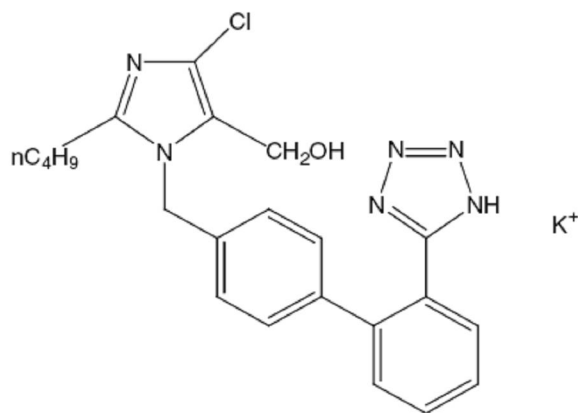
hyoscine butylbromide (HBB)

Structure (1)

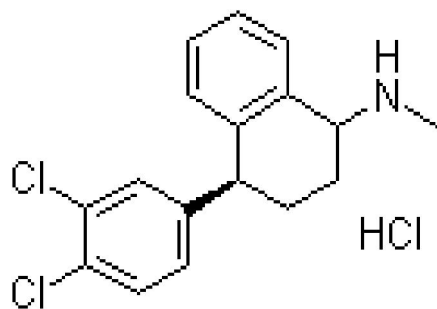
**Sertaline hydrochloride (Sert)**, (1S,4S)-4-(3,4-dichlorophenyl)-N-methyl-1,2,3,4-tetrahydronaphthalen-1-amine hydrochloride, is a selective serotonin reuptake inhibitor (SSRI) with



actions and uses similar to those of fluoxetine (Structure 3). Sertraline is slowly absorbed from the gastrointestinal tract with peak plasma concentrations occurring from about 4.5 hours to 8.5 hours after ingestion. It undergoes extensive first-pass metabolism in liver. The main pathway is demethylation to N-desmethylsertraline, which is inactive; further metabolism and glucuronide conjugation occurs [26]. Sertraline is widely distributed throughout body tissues and is highly bound (about 98 %) to plasma proteins. Various methods have been used for the determination of sertraline hydrochloride, its metabolites in human plasma and in pharmaceutical dosage forms, including HPLC method [27] gas chromatography-mass spectrometry [28,29] spectrophotometric method [30].



**Losartan K (LSR)**  
**Structure(2)**



**(Structure 3)**

## 2. Experimental Section:

### 2.1. Apparatus:

ATI UNICAM (UV/Vis) Ver. 3.20 with scanning speed 200 nm/min, lamp change 325 nm,

and band width 2.0 nm, equipped with 10 mm matched quartz cells.

Jenway pH meter 3310 for pH measurements.

### 2.2 Materials and reagents:

All chemicals and reagents were of analytical grade and water was always bidistilled water

#### 2.2.1 Standard solution of drugs:

Stock solutions (100 µg mL<sup>-1</sup>) of the studied drugs were freshly prepared by dissolving 10 mg of the drug in distilled water and then, completed to the mark in a 100 mL calibrated flask with distilled water. Working standard solutions were prepared by suitable dilution of the stock. These solutions are stable for at least 1 week if kept in the refrigerator.

#### 2.2.2. Pharmaceutical formulations:

All the drugs in the pure form and formulations are provided by the Egyptian pharmaceutical companies in the local markets.

2.2.2.1 Hyoscine butylbromide (HBB) was supplied by Chemical Industries Development (CID), Egypt.

Pharmaceutical preparations:

1- Buscopan tablets (10 mg Hyoscine -N-Butylbromide per tab.)

2- Buscopan ampoules (20 mg Hyoscine -N-Butylbromide per amp.)

2.2.2.2 Losartanpotassium (LSR) was supplied by the Universal Industrial Pharmaceutical Company (Unipharma), Egypt & Amriya Pharmaceutical Industries, Alexandria, Egypt.

Pharmaceutical preparations:

1-Losar 50 tablets (50 mg Losartanpotassium per tab.) (Unipharma)

2- Losartan 50 tablets (50 mg Losartanpotassium per tab.) (Amriya)

2.2.2. 3 Sertraline hydrochloride (SER) was supplied by Apex pharma, Egypt & Pharco Pharmaceuticals Co. Alexandria, Egypt.

Pharmaceutical preparations:

1-Moodapex 50 tablets (50 mg Sertraline hydrochloride per tab.) (Apex pharma)

2- Sertral 50 tablets (50 mg Sertraline hydrochloride per tab.) (Pharco)

#### 2.2.3 Reagents:

Cobalt(II)-thiocyanate solution (method A) [5×10<sup>-3</sup> M] was prepared by dissolving 11.9 g of cobalt chloride hexahydrate and 28.13 g of ammonium-thiocyanate in 100mL of water [38].



Molybdenum (VI) solutions (method B),  $1 \times 10^{-3}$  M aq. solution was also prepared by dissolving an appropriate weight of ammonium molybdate tetrahydrate in bidistilled water containing a few drops of ammonia and standardized gravimetrically using 8-hydroxyquinoline [31]. Ammonium–thiocyanate and ascorbic acid 10% aqueous solutions were prepared in distilled water. Citrate buffer, 0.4 M, was prepared by mixing various volumes of 0.4M citric acid and 0.4M sodium citrate solutions to the required pH values (2.0–6.0) as recommended [32].

### 2.3. General procedures for drugs in pure form

#### 2.3.1. Method A (using cobalt(II)–thiocyanate)

Accurately measure aliquots of HBB, LSR or SER in the concentration ranges shown, were transferred into a 50 ml separating funnel, 5.0 ml of  $5 \times 10^{-3}$  M Co (II) thiocyanate solution and 5 ml of citrate buffer solution of the optimum pH 2.8, and 0.5 ml acetone were added successively. The volume of aqueous phase was adjusted to 20 ml with bidistilled water. Equilibrate the solution with 20 ml of n-butanol-dichloromethane mixture (3.5:6.5) by shaking for 1.0 min. The organic layer was separated and dried over anhydrous sodium sulfate. Into a 25 ml calibrated flask, the upper layer solution was filtrated through a Whatman No. 41 filter paper moistened with n-butanol-dichloromethane mixture, washed, if necessary, and adjust to the mark with the same solvent. The absorbance was then measured at 627 nm for SER, 630 nm for LSR and 625 nm for HBB versus a reagent blank prepared and treated similarly.

#### 2.3.2. Method B (using molybdenum (V) thiocyanate)

In 50 mL separating funnel, 2.0 mL of ( $1 \times 10^{-3}$  M) ammonium molybdate is added, 3.0 mL of HCl (4.0 M), 3.0 and 4.0 mL (10%) each of ammonium thiocyanate and ascorbic acid were mixed and left for 15 min at room temperature ( $20 \pm 5^\circ\text{C}$ ). Appropriate volumes of standard solutions in the concentration range stated were added and diluted with bidistilled water up to 20 ml. After another 10 min, 10 ml of methylene chloride was added twice with 5-ml portions, the mixture was shaken well for 1 min and allowed to separate into two phases. The organic layer was collected and dried over anhydrous sodium sulfate and its absorbance of the extract was measured at 465 nm for SER, 468 nm for LSR and 478 nm for HBB versus a reagent blank prepared similarly without the drugs.

### 2.4. Procedures for dosage form:

#### 2.4.1. Procedures for tablets

At least 10 tablets of the investigated drugs were weighted into a small dish and the contents of five drops bottles (1.0 g Dextromethorphan hydrobromide per 15 mL) and five ampoules (Buscopan amp, 20 mg HBB per ampoule) are mixed well. A portion equivalent to 100 mg was weight and dissolved in 100 ml water, shaken well and filtered through a sintered glass crucible G4 and washed with distilled water. Then, the filtrate and washings were diluted to 100 mL with distilled water in a 100 mL calibrated flask. An aliquot portion of the solutions was used for the determination of each drug according to the procedure mentioned above.

#### 2.4.2. Procedures for ampoules

The contents of five ampoules (20 mg HBB )were mixed and the average volume for one bottle or one ampoule was determined and quantitatively transferred into 100mLcalibrated flasks completed to the mark with water. An aliquot portion of the solutions was used for the determination of each drug according to the procedure mentioned above.

## 3. Results and discussion:

### 3.1. Method A (Using Cobalt (II) Thiocyanate)

The formation of the ion-pairs between the tertiary amine group of the drug and Co(II) thiocyanate binary complex occurs via the protonated nitrogen atom of the drug. Cobalt (II) thiocyanate complex is a classical reagent in pharmaceutical analysis. Several colorimetric methods for the determination of some drugs in pharmaceutical preparations use Co(II)-thiocyanate solution as a reagent forming blue-colored extractable ion-pairs. In this work the investigated drugs were found to react with the cobalt (II) tetrathiocyanate ions to form ion-pair complexes. This interaction and subsequent formation of the ion-pairs occurred in acidic medium via the protonated nitrogen atom of the drugs. Although, the weak  $[\text{Co}(\text{SCN})_4]^{-2}$  ion complex became stabilized through the formation of the ion-pairs with the studied drugs, those produced ion-pair complexes were still highly labile and needed a large excess of  $[\text{Co}(\text{SCN})_4]^{-2}$  ions to be stabilized in the aqueous phase. Therefore, the produced ion-pairs were further satisfactorily stabilized by extraction into organic solvents [33]. and thus were determined accurately without interference from the excess unreacted metal complex in the aqueous phase. Concerning our investigated drugs, the common non-polar organic solvents such as chloroform, dichloromethane, 1,2-dichloroethane, benzene, and nitrobenzene failed to extract the ion-pairs due to their insolubility while solvents with more polarity, such as n-butanol and isobutylmethylketone, lacked selectivity. Therefore solvent mixture of

dichloromethane and n-butanol were tried. Better results regarding selectivity and accuracy were achieved using 35% n-butanol in dichloromethane in which the ion-pairs exhibited a greenish blue color with maximum absorbance at 625 nm for HBB, 630 nm for LSR, and 627 nm for SER against a reagent blank.

The different experimental parameters affecting the formation of the ion-pair complexes were extensively studied to determine the optimal conditions for the assay procedure.

#### 3.1.1. Effect of pH

The results were obtained by varying the pH for the aqueous phase within the range of 1.5-5.0 using 0.4 M citrate buffer. A maximum absorption was clearly detected between 2.5-3.2 pH values at which the studied drugs were found to be maximally protonated thus helping the ion-pair formation.

#### 3.1.2. Effect of solvent mixture ratio

Dichloromethane was used as a solvent mixture with n-butanol to enhance the extraction selectivity of the latter toward the formed ion-pairs and considerably lower its extraction ability of the reagent blank. The study revealed that a volume ratio of 35% (regarding n-butanol/total volume of the organic phase) was the most suitable for the ion-pair extraction with minimal blank reading.

#### 3.1.3 Effect of reagents concentration

The Co(II) thiocyanate concentration suitable for ion pair formation and extraction, was found to be 5.0 ml of  $5 \times 10^{-3}$  M reagent in an aqueous solution of 20 ml proved to be required for maximum stabilization of the ion-pair associates as indicated by attainment of maximum absorbance.

#### 3.1.4. Effect of number of extractions, shaking time and stability

Reproducible absorbance readings were obtained after a single extraction with 20 mL of the solvent mixture and a 1 min shaking time. Acetone was considered to be an ideal diluent for the extraction process, because it increases the extraction efficiency. The studied ion-pairs were stable for more than 24 hours at 25 °C in the organic solvent.

#### 3.1.5. Reaction mechanism

A proposal for the reaction mechanism taking DEX as an example is presented in (Scheme 1). The shapes of the curves of the cobalt thiocyanate ion-pairs also indicated that the associates are too labile, as further indicated by the need for a large excess of the reagent to enhance stability of the ion-pairs.

#### 3.2. Method B (Using Molybdenum(V) Thiocyanate)

Molybdenum (V) formed by the reduction of molybdenum(VI) with ascorbic acid combines with ammonium thiocyanate to form a red binary molybdenum (V) thiocyanate complex in 0.8-3.2 M hydrochloric acid is non-extractable with methylene chloride [34]. On adding of the investigated drugs solution, an orange red ion-pair complex is formed and extractable with methylene chloride and had an absorption maximum at 478, 465 and 468 nm for HBB, SER and LSR respectively against a reagent blank (Fig. 6).

It was found that, the reduction probability of Mo(VI) to Mo(V) may occur by ascorbic acid or  $\text{SCN}^-$  in acidic media must be considered. It was also found that the rapidity, sensitivity and stability of Mo(V)-thiocyanate ion-pairs were depended on using ascorbic acid. Ascorbic acid gave reproducible values and masked many interfering ions.

#### 3.2.1. Effect of ammonium molybdate

The effect of ammonium molybdate on the formation of the ion-pair complex and their extraction in methylene chloride was studied (Fig. 22). It was found that 1.5 and 2.0 mL of  $1 \times 10^{-3}$  M ammonium molybdate in a final aqueous solution of 20 mL. Also, it was found that 3.0 mL of the studied drugs (10 % each) of ammonium thiocyanate and ascorbic acid in a final solution of 20 mL gave the maximum pronounced effect.

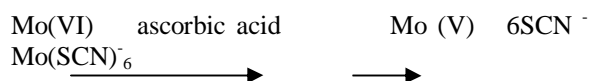
#### 3.2.2. Effect of Acidity

It was found that the ion-pair were formed only in hydrochloric, sulfuric, nitric or phosphoric acid medium. The optimum acidity concentration range for maximum absorbance values and for extraction, was found to be between 1.0-5.0 M hydrochloric acid. It was found that 3.0 mL of 4.0 M hydrochloric acid was sufficient for maximum absorbance and the formation of Mo(V) thiocyanate-drug ion-pairs.

#### 3.2.3. Effect of solvent

The common organic solvents such as methylene chloride, ethanol, methanol, chloroform, and benzene were examined. Methanol and other oxygenated solvents were found to extract both binary and ternary complex. Using slightly polar or non-polar solvents, such as dichloromethane and chloroform, the ternary complex could be extracted. Moreover, dichloromethane have high solubility of the ternary complex in this solvent. A double extraction was necessary to extract the complexes into the organic phase. An organic aqueous ratio of 1:2 was suitable for complex extraction of the ternary

complex. The organic red color in dichloromethane was quite stable for at least 24 hours. From the results an equation representing the reaction of Mo(VI) with ammonium thiocyanate in 4.0 M HCl and in the presence of ascorbic acid was suggested to be as follows:



In this method, the complete formations of the ion-pairs needs 10 min before extraction with methylene chloride at room temperature (25 °C). the absorbance of Mo(V)-thiocyanate binary complex was stable after 15 min while Mo(V)-thiocyanate-drugs ion-pairs need another 15 min for their complete formation.

### 3.3. Composition of the ion-pair associates

The composition of the ion-pair associates was established by Job's method of continuous variation [35] and molar ratio methods [36] using equimolar solutions of the drugs and reagents Mo(V) and Co(II) thiocyanate. The results obtained are shown in (Fig 5 and 8) and indicated that the composition of the associates was (2:1) (drug: reagent). This stoichiometric ratio supported that the interaction between the studied drugs and the reagent used took place at only one site which was the more sterically free terminal basic aliphatic amino group.

### 3.4. Method of Validation

Under the experimental conditions described above, the calibration graphs for the four drugs were constructed for both methods over the concentration ranges cited in (Table 1). the molar absorptivities, the Sandell sensitivities and the regression equations, intercepts, slopes, and correlation coefficients for the calibration data for each drug are tabulated. The results obtained were compared with those of the official methods. Detection limits (3 $\sigma$ ) and statistical analysis of the obtained results revealed that there is no significant difference between both as shown in (Table 1). Six replicate determinations at different concentration levels were carried out to test the precision of the methods. The relative standard deviations were found to be less than 1.4 %, indicating reasonable repeatability of the selected methods. The results obtained for each drug using the

proposed Co(II) or Mo(V) thiocyanate methods are sensitive. The performance of the proposed methods was assessed by comparison with the official method. Mean values were obtained with a Student's *t*- and *F*-tests at 95% confidence limits for five degrees of freedom. The results showed comparable accuracy (*t*-test) and precision (*F*-test), since the calculated values of *t*- and *F*-tests were less than the theoretical data (Table 1).

### 3.4.5. Analytical Applications

The proposed methods were applied to the determination of Hyoscine n-Butylbromide and Sertraline hydrochloride (SER) and Losartan potassium (LSR) in pure and dosage forms using the standard additions method. The obtained results are given in (Tables 2-4) for the analysis of commercial preparations. The proposed methods have the advantage of being virtually free from interference (either from excipients such as lactose, fructose and starch or from common degradation products). Therefore, the standard addition principle was used to evaluate the accuracy of the proposed methods and to test interferences (Tables 2-4). The recoveries% of the drugs in their commercial preparations compared with that of the reference methods are given in (Table 5).

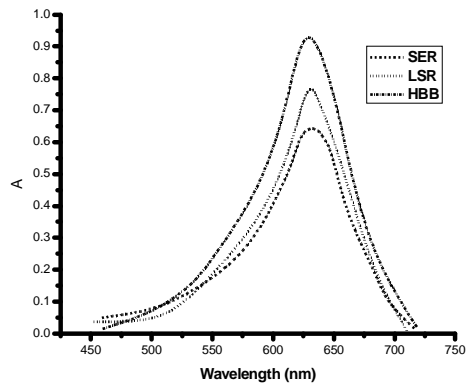
## 4. Conclusions

The proposed methods described in this paper are simple, rapid, and applicable for routine analysis of some drugs, e.g., Hyoscine butyl bromide (HBB), losartan potassium (LSR) and Sertaline HCl (SER) in bulk and in their pharmaceutical formulations through the formation of ion-pairs by the reaction of the studied drugs and cobalt (II) or molybdenum (V) and thiocyanate over a wide concentration range without interference from common excipients. Moreover, it exhibits the advantage of being convenient at low cost without losing accuracy.

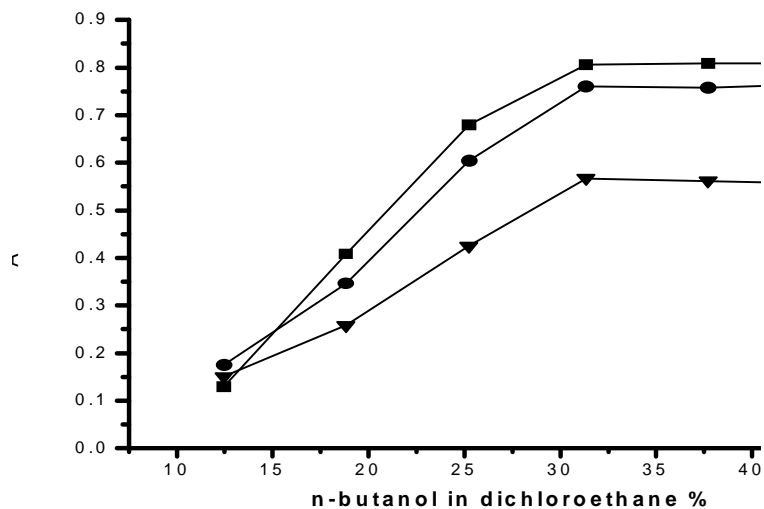
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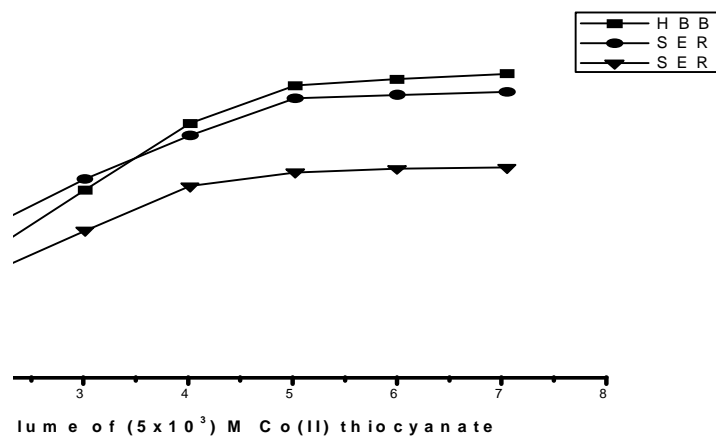
Chemistry Department, Faculty of Science,  
Mansoura University, Mansoura, Egypt  
[magdaakl@yahoo.com](mailto:magdaakl@yahoo.com)



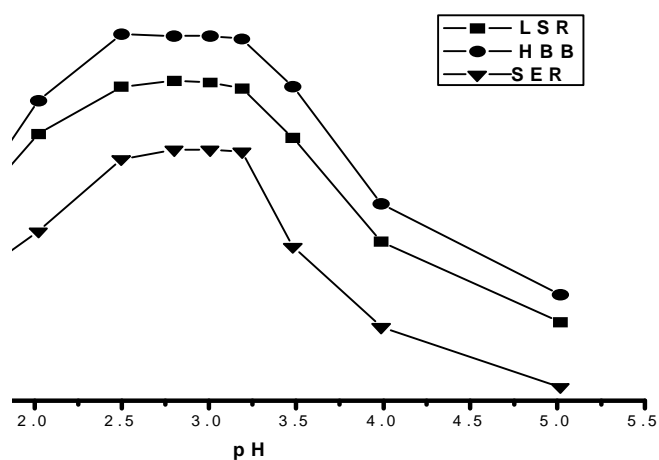
**Figure (1)** Absorption spectra of the ion-pair associates formed between ( $5.0 \times 10^{-3}$  M) cobalt (II) thiocyanate complex and the studied drugs, SER at  $\lambda_{\text{max}} = 627$  nm, LSR at  $\lambda_{\text{max}} = 630$  nm and HBB at  $\lambda_{\text{max}} = 625$  nm in n-butanol- dichloromethane.



**Figure (2)** Effect of n-butanol concentration on the extraction efficiency of the formed ion-associates of the studied drugs with cobalt (II) thiocyanate complex.

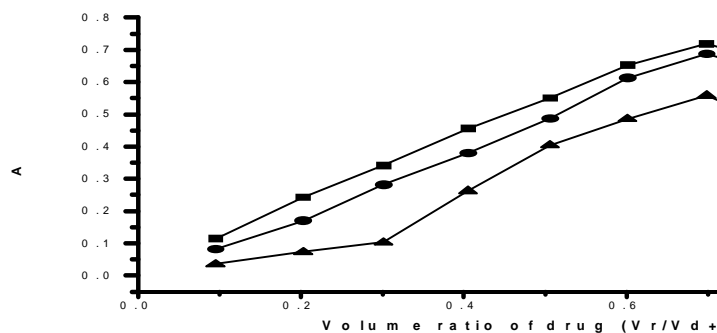


**Figure (3)** Effect of cobalt (II) thiocyanate concentration on the development of the ion-associates of the studied drugs .

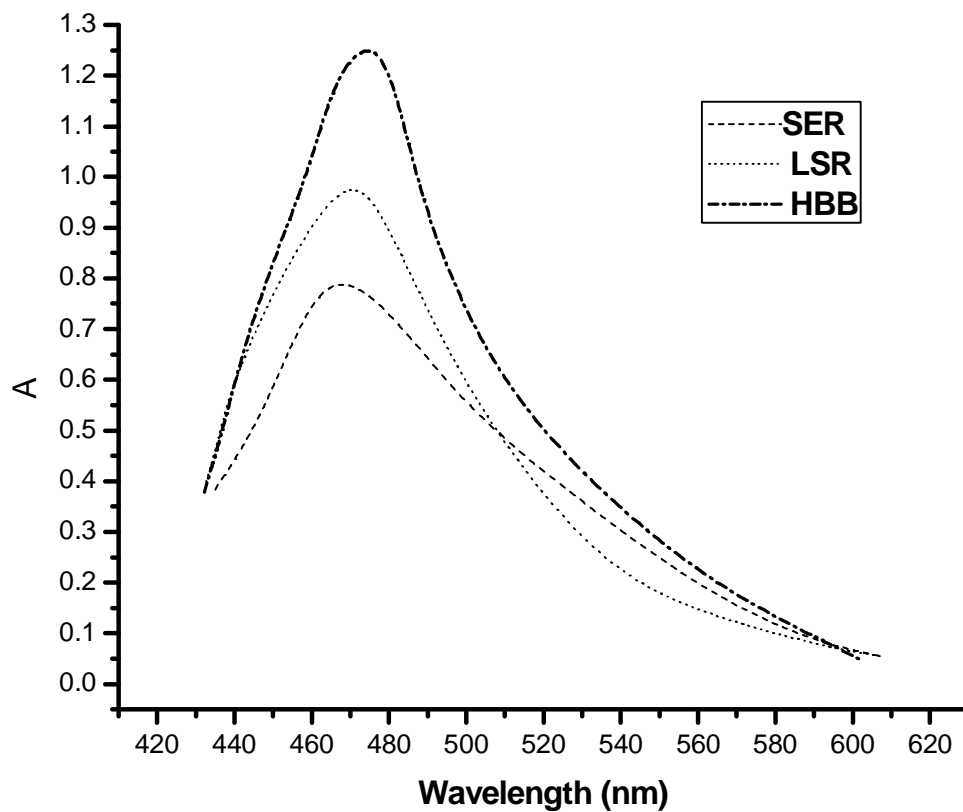


**Figure (4)** Effect of pH on the development of the ion associates of the studied drugs with cobalt (II) thiocyanate complex .

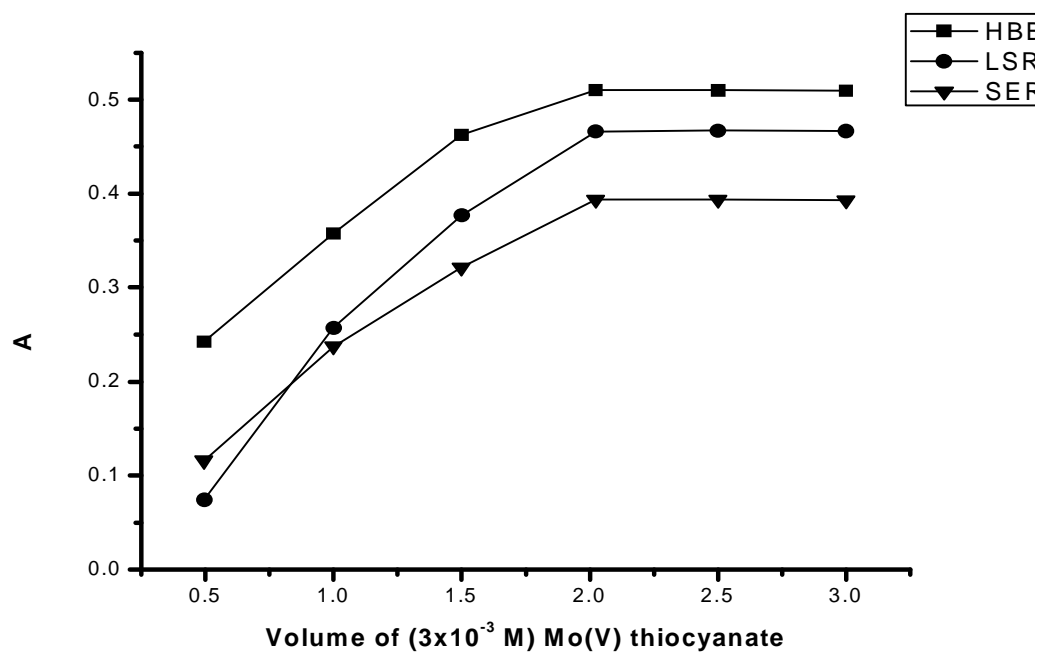




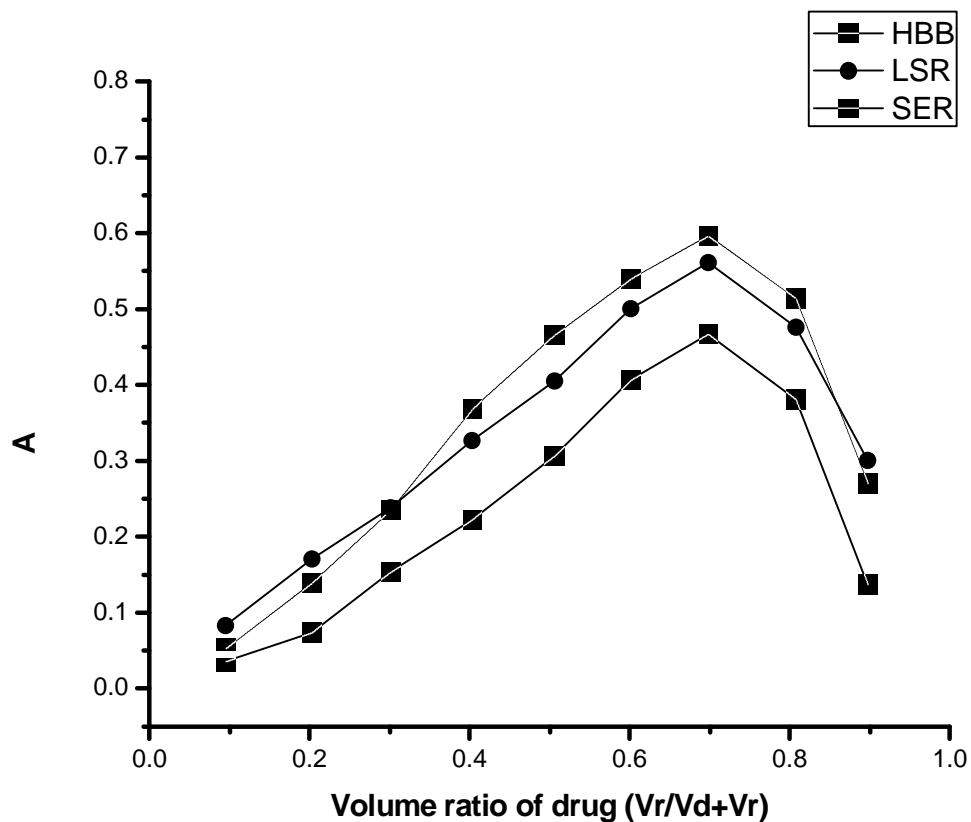
**Figure (5)** Continuous variation plots for the ion-association complexes of the studied drugs with ( $5 \times 10^{-3}$  M) with cobalt (II) thiocyanate complex Where,  $V_d$  and  $V_r$  are the volumes of added drug and reagent, respectively;  $(V_d + V_r) = 1$  mL.



**Figure (6)** Absorption spectra of Mo(V) ion-pairs in methylene chloride vs. Reagen blank. 1:SER 465 nm, 2: LSR468 nm and 3:HBB 478 nm



**Figure(7)** Effect of Mo (V) thiocyanate concentration on the development of the ion-associates of the studied drugs.



**Figure (8)** Continuous variation plots for the ion-association complexes of the studied drugs with ( $1 \times 10^{-3}$  M) with Mo (V) thiocyanate complex. Where,  $V_d$  and  $V_r$  are the volumes of added drug and reagent, respectively; ( $V_d + V_r$ ) = 1 mL.

**Table (1). Analytical Parameters for The determination of The studied Drugs by The proposed Methods.**\*  $A = a + bC$ , where C is the concentration in ( $\mu\text{g mL}^{-1}$ ), A is the absorbance, a is the intercept and b is the slope.

Parameters	Co(II) thiocyanate			Mo(V) thiocyanate		
	SER	LSR	HBB	SER	LSR	HBB
max	627	630	625	465	468	478
Conc. Range( $\mu\text{g mL}^{-1}$ )	20-300	35-350	50-400	5-30	4-50	5-45
Molar absorptivity , ( $\text{L mol}^{-1} \text{cm}^{-1}$ ) $\times 10^4$	0.231	0.1229	0.1782	1.155	1.745	1.332
Sandel sensitivity, ( $\mu\text{g cm}^{-2}$ )	0.318	0.258	0.511	0.054	0.027	0.043
Regression equation *						
Intercept	0.052	0.0172	0.0312	0.025	0.198	0.014
Slope	0.0036	0.0014	0.0022	0.0244	0.0155	0.017
Correlation coefficient (r)	0.9997	0.9990	0.9998	0.9997	0.9998	0.9998
RSD%	1.64	1.23	1.44	1.3	0.8812	1.291
Detection limits ( $\mu\text{g mL}^{-1}$ )	0.59	0.84	0.77	0.52	0.26	0.18
SE	0.442	0.563	0.37	0.71	0.32	0.44
V	1.947	1.44	1.62	1.39	1.91	1.93
Mean $\pm$ SD	100.16 $\pm$ 1.6	99.18 $\pm$ 1.2	100.11 $\pm$ 1.44	100.36	100.45 $\pm$ 0.6	99.82 $\pm$ 1.2
	4	3		$\pm$ 1.31	4	91
Reference method	99.53 $\pm$	100.08 $\pm$	99.22 $\pm$ 1.39	99.53 $\pm$	100.08 $\pm$	99.22
	1.47	1.06		1.47	1.06	$\pm$ 1.39
Calculated t-value (2.57)**	0.63	1.21	1.07	0.85	0.67	0.68
Calculated F-value (5.05)**	1.31	1.46	1.11	1.20	2.74	1.00

\*\* Theoretical values for five degrees of freedom and 95 % confidence level at  $p = 0.05$  Miller (1993).**Table (2). Application of The standard Addition Technique for The Determination of SER in Pharmaceutical Preparations Using The Proposed Methods.**

Sample	Co(II)-thiocyanate			Mo(V)-thiocyanate		
	Taken ( $\mu\text{g mL}^{-1}$ )	Added ( $\mu\text{g mL}^{-1}$ )	Recovery* (%)	Taken ( $\mu\text{g mL}^{-1}$ )	Added ( $\mu\text{g mL}^{-1}$ )	Recovery* (%)
Moodapex 50 Tablets (50 mg SER / tab)	100	-	100.08	10	-	99.65
		40	99.97		4	100.30
		80	99.5		10	98.93
		120	98.88		16	99.45
		150	99.75		22	100.50
		180	100.2		26	99.70
Mean $\pm$ SD			99.73 $\pm$ 0.49			99.76 $\pm$ 0.57
N			5			5
V			0.235			0.33
R.S.D			0.49			0.57
S.E			0.198			0.234
Sertral 50 Tablets (50 mg SER / tab)	100	-	99.98	10	-	100.15
		40	100.08		4	99.85
		80	100.25		10	98.95
		120	99.91		16	99.97
		150	100.4		22	100.5
		180	99.87		26	100.3
Mean $\pm$ SD			100.08 $\pm$ 0.21			99.95 $\pm$ 0.54
N			5			5
V			0.043			0.295
R.S.D			0.21			0.54
S.E			0.085			0.222

\* The average of at least three determinations.

**Table (3). Application of The standard Addition Technique for The determination of HBB in Pharmaceutical Preparations Using The Proposed Method**

Sample	Co(II)-thiocyanate			Mo(V)-thiocyanate		
	Taken ( $\mu\text{g mL}^{-1}$ )	Added ( $\mu\text{g mL}^{-1}$ )	Recovery* (%)	Taken ( $\mu\text{g mL}^{-1}$ )	Added ( $\mu\text{g mL}^{-1}$ )	Recovery* (%)
Buscopan Tablets (10 mg HBB / tab.)	100	-	100.7	10	-	99.56
		50	100.27		5	99.41
		100	99.91		10	98.39
		150	99.48		15	101.56
		200	98.71		20	100.34
		250	99.64		25	99.52
Mean $\pm$ SD			99.79 $\pm$ 0.69			99.80 $\pm$ 1.06
N			5			5
V			0.472			1.133
R.S.D			0.69			1.06
S.E			0.28			0.435
Buscopan Ampoules (20 HBB/amp.)	100	-	100.12	10	-	100.32
		50	101.03		5	99.47
		100	99.74		10	100.55
		150	99.71		15	99.59
		200	98.96		20	100.27
		250	99.88		25	99.93
Mean $\pm$ SD			99.91 $\pm$ 0.674			100.02 $\pm$ 0.43
N			5			5
V			0.454			0.186
R.S.D			0.674			0.43
S.E			0.275			0.176

\* The average of at least three determinations.

**Table (4). Application of The standard Addition Technique for The determination of LSR in Pharmaceutical Preparations Using The Proposed Methods.**

Samples	Official methods	Co(II)-thiocyanate	Mo(V)-thiocyanate
Buscopan Tablets			
X $\pm$ SD	99.70 $\pm$ 1.163	100.02 $\pm$ 1.24	99.94 $\pm$ 0.975
t-value (2.57)*		0.42	0.35
F-value (5.05)*		1.14	1.43
Buscopan Drops			
X $\pm$ SD	100.50 $\pm$ 1.364	100.06 $\pm$ 1.18	99.84 $\pm$ 1.57
t-value (2.57)*		0.55	0.71
F-value (5.05)*		1.34	1.32
Losartan 50 Tablets			
X $\pm$ SD	98.92 $\pm$ 0.852	99.37 $\pm$ 0.624	99.60 $\pm$ 1.03
t-value (2.57)*		0.96	1.13
F-value (5.05)*		1.86	1.46
Losar 50 Tablets			
X $\pm$ SD	99.22 $\pm$ 1.39	99.72 $\pm$ 1.08	99.93 $\pm$ 1.25
t-value (2.57)*		0.63	0.85
F-value (5.05)*		1.66	1.24
Sertral 50 Tablets			
X $\pm$ SD	99.90 $\pm$ 0.51	100.07 $\pm$ 0.477	99.48 $\pm$ 0.63
t-value (2.57)*		0.54	1.16
F-value (5.05)*		1.14	1.53
Moodapex 50 Tablets			
X $\pm$ SD	98.97 $\pm$ 0.52	99.18 $\pm$ 0.39	98.60 $\pm$ 0.46
t-value (2.57)*		0.72	1.19
F-value (5.05)*		1.78	1.28

\*The average of at least three determinations



**Table (5).** Application of The proposed Methods to The determination of the studied Drugs in Pharmaceutical Preparations

Sample	Co(II)-thiocyanate			Mo(V)-thiocyanate		
	Taken ( $\mu\text{g mL}^{-1}$ )	Added ( $\mu\text{g mL}^{-1}$ )	Recovery* (%)	Taken ( $\mu\text{g mL}^{-1}$ )	Added ( $\mu\text{g mL}^{-1}$ )	Recovery* (%)
Losartan 50 Tablets (50 mg LSR / tab.)	100	-	100.16	10	-	99.98
		50	101.17		5	100.15
		100	99.27		10	101.24
		150	98.65		20	99.95
		200	99.59		30	99.84
		300	100.09		40	100.39
Mean $\pm$ SD			99.82 $\pm$ 0.864			100.26 $\pm$ 0.52
N			5			5
V			0.747			0.268
R.S.D			0.864			0.52
S.E			0.353			0.211
Losar 50 Tablets (50 mg LSR / tab)	100	-	99.96	10	-	100.40
		50	100.05		5	99.67
		100	98.75		10	101.2
		150	99.19		20	100.35
		200	99.94		30	99.60
		300	100.18		40	98.95
Mean $\pm$ SD			99.68 $\pm$ 0.57			100.03 $\pm$ 0.79
N			5			5
V			0.328			0.62
R.S.D			0.57			0.79
S.E			0.234			0.321

\* theoretical values at P= 0.05 at 95 % level.

\*\* average of six determinations.

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## Causes and Types of Conflict and Resolution Strategies among Nursing Students: A Comparative Study between Two Cultures

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**Abstract:** Purpose: To compare the causes, types, and applied conflict resolutions strategies among nursing students at Ain-Shams University in Egypt and Beirut Arab University in Lebanon. Methods: Design: This comparative cross-sectional study was conducted on a convenience sample of 202 Egyptian and 75 Lebanese nursing students during the academic year 2009/2010. Data collection was through a self-administered form including a questionnaire for conflict causes (Cronbach alpha coefficient =0.955) and the conflict strategies inventory (Cronbach alpha coefficient =0.829). Findings: Time pressure was the most common cause of conflict among Egyptian (42.6%) and Lebanese (42.7%) students, and the intra-person type was the most prevalent among them, 32.2% and 17.3%, respectively. Egyptians had more use of accommodating ( $p=0.02$ ), collaborating ( $p=0.006$ ), competing ( $p=0.007$ ), and avoiding ( $p=0.006$ ) strategies. The competing, compromising, and avoiding strategies had weak positive statistically significant correlations with all types of conflict in the Egyptian sample, the strongest being between compromising and inter-person type ( $r=0.394$ ). Among Lebanese, a weak negative statistically significant correlation was found between competing and inter-person type ( $r=-0.250$ ). Conclusion: The study provides preliminary evidence of a possible influence of culture and ethnicity on the causes and types of conflict, and the resolution strategies used. Further research is needed in this area, preferably comparing more widely different cultures. Clinical relevance: Cultural factors and ethnic differences should be considered in conflict resolution training programs, particularly in multi-ethnic communities.

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**Keywords:** conflict resolution strategies, nursing students, culture, ethnic

### 1. Introduction:

Conflict which is natural result of human communication is generally defined as the consequence of real or perceived differences in mutually exclusive goals, values, ideas, attitudes, beliefs, feelings, expectations or actions within the individual or between two persons or parties (Marquis and Huston, 2009). It is an inevitable phenomenon in any organization. Universities as educational organizations do experience conflicts between different groups within its jurisdiction as between student-student, student-instructor, student-authority (Lussier, 2006; Adebayo, 2009).

Conflict can be categorized according to situation into intrapersonal, interpersonal, intragroup, and intergroup types (Roussel et al., 2006). It can also be positive or negative, healthy or dysfunctional. A certain amount of conflict is beneficial to individuals as it can increase creativity by acting as a stimulus for developing new ideas or identifying methods for solving problems. It also helps people recognize legitimate differences within the organization or profession and serves as a powerful motivator to

improve performance and satisfaction (Hagel and Brown, 2005).

Students come to colleges with different experiences, fears, expectations, attitudes, backgrounds, hopes, and aspiration which may lead to conflict between groups (Adebayo, 2009). Moreover, conflict can occur in colleges between students and faculty management, students and teachers or instructors, students and managers, and students and students (Miklas and Kleiner, 2003). In these situations, conflicts can take place for different reasons as lack of openness, time or feedback, communication problems, anger and irritation, low performance and responsibilities, and disobedience to the rules and policies (Osinchuk, 1995; Adrian-Taylor 2007).

One of the most important factors in effective and constructive management of conflict is the style used to resolve it (Rahim et al., 2000). Conflict management style is the general attitude reflected in responding to conflict in reciprocal interactions of individuals (Xu and Davidhizar, 2004). Commonly, there are five strategies for managing conflict: avoiding, accommodating,

competing, compromising, and collaborating (Lussier, 2006).

In avoiding style, the user attempts to passively ignore the conflict rather than resolve it. The individual shows a low level of concern for the self and for the other side (Kantek and Gezer, 2009). Accommodating or smoothing conflict style is unassertive but cooperative through complimenting one's opponent and focusing on minor areas of agreement (Certo, 2003). It may be appropriate in dealing with minor problems (Yoder-Wise, 2007). Conversely, competing or forcing conflict style is assertive and uncooperative. The individuals do all effort to win, regardless of the cost. It may be needed in situations involving unpopular or urgent decisions (Sullivan and Decker, 2005; Lussier, 2006). The compromising or negotiating style is moderately assertive and cooperative based on give-and-take approach (Rahim, 2000). It can serve as a backup to resolve conflict when collaboration is ineffective and when opponents are of equal power (Roussel and Swansburg, 2009). The collaborating or problem solving style resolves conflict by working together with the other person to find an acceptable solution (Lussier, 2006). It is considered the most effective means for resolving conflicts (Sullivan and Decker, 2005).

### Significance of the study

Conflict management skills are valued in medical and nursing education as a means of fostering teamwork and collaboration among health care professionals. This value is based on two assumptions. First, conflicts faced by students in teaching organizations have a direct effect on performance as well as the outcome of learning experience. Second, the responsibility of nursing colleges is to increase the ability and competency of their students to establish working relationships with diverse individual and groups of people as future professionals. As conflict causes and management depend on the cultural and environmental factors within the organization, it was deemed important to compare them in two related but different settings.

The aim of this study is to provide nursing educationalists with useful information about conflict in different cultures through comparing the causes, types, and applied conflict resolutions strategies among nursing students of Ain-Shams University in Egypt and Beirut Arab University in Lebanon.

## 2. Methods:

### Research Design and Setting

A comparative cross-sectional design was used in this study, which was done at two faculties of nursing, one affiliated to Ain-Shams University in

Egypt, and the other affiliated to Beirut Arab University in Lebanon. The researchers selected those two countries because, although both are Arab countries, they have marked differences in historical dimensions and ethnicity, political environment, legislation, and economic and social structure.

### Subjects

The study subjects consisted of nursing students from the four grades in the academic year 2009-2010, with the only inclusion criterion of being a full-time student during the time of the study. The Egyptian group included 202 students from the Faculty of Nursing at Ain Shams University. The Lebanese group included all the students in the Health Sciences Nursing Department, at Beirut Arab University. Their number was 75; 10 were selected for the pilot study, while 15 refused to participate in the study.

The sample size was calculated to detect any difference of 20% in conflict types or resolving styles prevalent with a rate of 50% or more, at 95% confidence level and 80% study power, using the sample size equation for a difference between two proportions (Schlesselman, 1982). As the total number of Lebanese students was limited, it was decided to calculate the sample size with proportion 3:1 for Egyptian and Lebanese groups, respectively. Accordingly, the required sample size was 201 and 67 students, respectively. As the number of students who accepted in the Lebanese school was 75, which is close to the required sample size, it was decided to include all of them. For the Egyptian group, randomized sampling was used to recruit students to achieve the required sample size. The number of students recruited in the four academic years was proportional to the number of students in each year.

### Tools of data collection

Two tools were used for data collection, namely the conflict causes questionnaire, and the conflict strategies inventory.

### Conflict causes questionnaire:

This tool was derived mainly from Rahim Organizational Conflict Inventory I (ROCI-I), which has proved construct, criterion, convergent and discriminant validity as well as internal consistency (Rahim, 1983). It was modified by the researchers guided by Certo (2003), Marquis and Huston (2009) to identify the causes and types of conflicts among nursing students. The questionnaire included 56 items in Arabic language to identify the causes and types of conflict. The responses were on a 5-point Likert scale: always, frequently, sometimes, rarely, and never occur. The items were classified

into ten causes and four types. The ten causes were related to teacher behavior (10), professional development (3), faculty management authority (4), incompatible values/goals (3), home-study interface (4), team work relations (8), student reward/discipline system (4), role ambiguity (2), time pressure (3), and clinical learning environment (15). The four types of conflict were intra-group (16), intra-person (9), inter-group (29), and inter-person (2). The tool was appended with a part for basic demographic characteristics as age, sex, academic year, residence, pre-university qualification. The tool was rigorously revised by a jury group of experts in nursing management for content validity using a Delphi technique. The process involved translation-re-translation, addition, deletion, and rephrasing of items as requested by experts. It was then pilot tested for reliability assessment, and proved to have Cronbach alpha coefficient 0.955, indicating a very high degree of reliability.

Scoring: scores 5 to 1 were respectively given to responses from always to never. For each student, the mean score of each type or cause was calculated and converted into a percent score. A score of 60% or higher indicated the presence of the conflict cause or type or its high level.

#### **Conflict strategies inventory:**

This tool was adopted from Rahim Organizational Conflict Inventory II (ROCI II), which was developed for determining what styles people use to handle conflict and also has proved construct, criterion, convergent and discriminant validity as well as internal consistency. The tool has 30 items equally divided among the five conflict management styles of accommodating, collaborating, competing, compromising, and avoiding. The responses are on a 5-point Likert scale: always, frequently, sometimes, rarely, and never occur; a higher score indicates that a particular style is used more (Rahim, 1983). The tool was modified and translated into Arabic using the translation-re-translation method to ascertain its validity. The scoring was similar to the first tool. Additionally, for each student the strategy with the highest score was considered as the predominantly used strategy. The reliability was tested, and Cronbach alpha coefficient was 0.829, indicating very high reliability.

#### **Procedures**

Official permission was obtained to perform the study after reviewing its ethical aspects by the Ethics Committees in both faculties. A pilot study was done on 10% of the sample students; accordingly the tools and data collection plan were finalized. Pilot subjects were not included in the study sample. Data

were collected three days per week. A verbal informed consent was obtained from each participant after explaining the purpose of the study and informing him/her about the rights to refuse or withdraw from the study at any time. Confidentiality of the data was ascertained. The questionnaires were anonymous and self-administered.

#### **Statistical analysis**

Data entry and statistical analysis were done using SPSS 14.0 statistical software packages. Quantitative continuous data were compared using Student t-test in case of comparisons between two groups. Qualitative categorical variables were compared using chi-square test. Whenever the expected values in one or more of the cells in a 2x2 tables was less than 5, Fisher exact test was used instead. In larger than 2x2 cross-tables, no test could be applied whenever the expected value in 10% or more of the cells was less than 5. Pearson correlation analysis was used for assessment of the inter-relationships among quantitative variables, and Spearman rank correlation for ranked ones. Statistical significance was considered at p-value <0.05.

#### **3. Results:**

The socio-demographic characteristics of nursing students in the two study groups showed in (Table 1). The age of Egyptian students group ranged between 17-25 years ( $19.3 \pm 2.6$  years). The age of Lebanese students group ranged between 17-48 ( $21.2 \pm 4.5$  years). The majority of students in the two groups had general secondary school as pre-university qualification (87.1 and 84.5% respectively). Also more than half of Egyptian students (52.0%) had rural residence, compared to 9.3% among Lebanese students. It is also noticed that the majority of Egyptian and Lebanese students chose the faculty of nursing by their own will (71.8% and 85.3%, respectively). Additionally, 45% of Egyptian students group were male compared to 52 % male students among Lebanese group.

Concerning the causes and types of conflict, Table (2) demonstrates that time pressure was the most commonly mentioned by both Egyptian and Lebanese students (42.6% and 42.7%, respectively). Statistically significant differences are noticed between the two groups in almost all causes of conflict with exception to role ambiguity and time pressure as causes of conflict. In all these differences, the causes of conflict were higher among Egyptian students. As for the types of conflict, the table indicates that the intra-person type was the most prevalent among both Egyptian (32.2%) and Lebanese (17.3%) students. Also, statistically



significant differences were observed between the two groups in almost all types of conflict, the only exception being in inter-person conflict. In all these types, the prevalence was higher among Egyptian students.

Table (3) shows a comparison of the conflict resolution strategies used in the two study groups. It shows statistically significantly higher use of accommodating ( $p=0.02$ ), collaborating ( $p=0.006$ ), competing ( $p=0.007$ ), and avoiding ( $p=0.006$ ) strategies by Egyptian students. The collaborating strategy was the most used in both groups, whereas the avoiding was the least among Egyptian students, and the competing was the least among Lebanese students. The table also indicates that the collaborating strategy was the most common predominant strategy used by both Egyptian (64.9%) and Lebanese (49.3%) students. Also, a statistically significant difference was revealed, with more use of competing and avoiding strategies by Lebanese students, and more use of collaborating and accommodating strategies by Egyptian students,  $p<0.001$ .

As for the relation between the scores of conflict types and conflict resolution strategies, Table (4) demonstrates no statistically significant correlations between the accommodating style and

any of the four types of conflict. Meanwhile, the competing, compromising, and avoiding strategies had weak positive statistically significant correlations with all types of conflict among Egyptians, the strongest being between compromising and inter-person type ( $r=0.394$ ). Among Lebanese, a weak negative statistically significant correlation was found between the competing strategy and the inter-person type of conflict ( $r=-0.250$ ). The collaborating strategy had a weak negative statistically significant correlation with the intra-group conflict in the Egyptian ( $r=-0.169$ ) and Lebanese ( $r=-0.231$ ) groups, and on the inter-person type in the Lebanese group ( $-0.368$ ).

Table (5) illustrates the correlation between the scores of conflict resolution strategies and students' age and academic years. The table shows weak positive statistically significant correlations between the academic year of Egyptian students and each of their scores of competing, compromising, and avoiding strategies ( $r=0.183$ ,  $0.251$ ,  $0.230$ , respectively). Also, there were weak positive statistically significant correlations between their age and the scores of avoiding ( $r=0.235$ ) and compromising ( $r=0.189$ ) strategies. As for the Lebanese sample, no statistically significant correlations could be demonstrated.

**Table 1. The socio-demographic characteristics of nursing students in the two study groups**

	Group			
	Egyptian (n=202)		Lebanese (n=75)	
	No.	%	No.	%
Age (years):				
<20	103	51.0	22	29.3
20+	99	49.0	53	70.7
Range	17.0-25.0		17.0-48.0	
Mean±SD	19.3±1.6		21.2±4.5	
Sex:				
Male	91	45.0	39	52.0
Female	111	55.0	36	48.0
Academic year:				
1	56	27.7	18	24.0
2	41	20.3	13	17.3
3	43	21.3	17	22.7
4	62	30.7	27	36.0
Pre-university qualification:				
General	176	87.1	63	84.0
Nursing school	9	4.5	11	14.7
Nursing technical institute	17	8.4	1	1.3
Choice of career:				
Forced	57	28.2	11	14.7
Willing	145	71.8	64	85.3
Residence:				
Urban	97	48.0	68	90.7
Rural	105	52.0	7	9.3

**Table 2. Comparison of the sources and types of conflict among nursing students in the two study groups**

	Group				X <sup>2</sup> Test	p-value
	Egyptian (n=202)		Lebanese (n=75)			
	No.	%	No.	%		
Causes of conflict:						
Teacher behavior	55	27.2	7	9.3	10.08	0.001*
Professional development	52	25.7	6	8.0	10.40	0.001*
Faculty management authority	60	29.7	11	14.7	6.49	0.01*
Incompatible values/goals	34	16.8	5	6.7	4.67	0.03*
Home-study interface	71	35.1	14	18.7	6.99	0.008*
Team work relations	40	19.8	5	6.7	6.94	0.008*
Student reward/discipline system	65	32.2	10	13.3	9.84	0.002*
Role ambiguity	53	26.2	12	16.0	3.19	0.07
Time pressure	86	42.6	32	42.7	0.00	0.99
Clinical learning environment	45	22.3	1	1.3	17.32	<0.001*
Types of conflict:						
Intra-group	41	20.3	2	2.7	12.96	<0.001*
Intra-person	65	32.2	13	17.3	5.96	0.01*
Inter-group	38	18.0	2	2.7	11.54	0.001*
Inter-person	48	23.8	10	13.3	3.59	0.06

(\*) Statistically significant at p&lt;0.05

**Table 3. Comparison of the conflict resolution strategies used by nursing students in the two study groups**

	Group				X <sup>2</sup> Test	p-value
	Egyptian (n=202)		Lebanese (n=75)			
	No.	%	No.	%		
Conflict resolution strategies:						
Accommodating	66	32.7	14	18.7	5.22	0.02*
Collaborating	141	69.8	39	52.0	7.62	0.006*
Competing	48	23.8	7	9.3	7.16	0.007*
Compromising	36	17.8	10	13.3	0.80	0.37
Avoiding	20	9.9	17	22.7	7.70	0.006*
Predominant strategy used:						
Accommodating	39	19.3	2	2.7	41.64	<0.001*
Collaborating	131	64.9	37	49.3		
Competing	8	4.0	18	24.0		
Compromising	9	4.5	5	6.7		
Avoiding	15	7.4	13	17.3		

(\*) Statistically significant at p&lt;0.05

**Table 4. Correlations between the scores of conflict types and conflict resolution strategies**

Conflict resolution strategies	Pearson correlation coefficient			
	Types of conflict			
	Intra-group	Intra-person	Inter-group	Inter-person
Egyptian (n=202)				
Accommodating	0.040	0.033	0.097	0.076
Collaborating	-0.169*	-0.051	-0.136	-0.049
Competing	0.351**	0.250**	0.336**	0.260**
Compromising	0.215**	0.229**	0.318**	0.394**
Avoiding	0.156*	0.198**	0.206**	0.200**
Lebanese (n=75)				

Accommodating	-0.108	0.081	-0.038	-0.115
Collaborating	-0.231*	0.012	-0.190	-0.368**
Competing	0.002	-0.084	-0.095	-0.250*
Compromising	-0.102	0.100	-0.019	-0.201
Avoiding	-0.177	0.077	-0.107	-0.039

(\*) Statistically significant at  $p < 0.05$ (\*\*) statistically significant at  $p < 0.01$ **Table 5. Correlations between the scores of conflict resolution strategies and students' age and academic years**

Conflict resolution strategies	Pearson correlation coefficient	
	Age	Academic year <sup>#</sup>
Egyptian (n=202)		
Accommodating	0.090	0.060
Collaborating	-0.062	-0.104
Competing	0.103	0.183**
Compromising	0.189**	0.251**
Avoiding	0.235**	0.230**
Lebanese (n=75)		
Accommodating	0.155	0.030
Collaborating	0.148	0.155
Competing	0.000	0.009
Compromising	0.096	0.010
Avoiding	0.143	-0.028

(\*) Statistically significant at  $p < 0.01$ 

(#) Spearman rank correlation

#### 4. Discussion:

In this study the causes and types of conflict among two nursing faculties students in Egypt and Lebanon were compared and the applied conflict resolutions strategies by those students of both countries were examined. The study revealed statistically significant differences between the two groups in the causes and types of conflict, as well as in the resolution strategies used.

The present study findings revealed that almost all conflict types were significantly higher among Egyptian students. These differences might be explained by a number of characteristics of the students and the settings. For students, the Lebanese were older in age and mostly from urban areas. For the settings, apart from the larger number of students and lower availability of resources, the Egyptian setting has a more restrictive system in primary and secondary schools, which does not provide the student with the communication skills needed for university life; this may hinder the ability of youth to accommodate with norms and expectations of the new university society. In line with this, Shazly et al. (2005) identified environmental factors in the setting

as independent predictors of conflict among nurse interns.

Regarding conflict resolution strategies, the present study demonstrated a preference for the collaborating strategy by two studied groups. This was also the most predominant as it leads to win-win situation. Kocaman (2003) explained the high use of this strategy in nursing by the emphasis on interpersonal relationships, communication and interaction in the nursing education curriculum, as well as skills employed during practice, such as assessing patients holistically, identifying their needs, and listening to them. The finding is in agreement with Steele (2003) who showed that the collaboration strategy worked successfully both at the individual and group levels among medical students. Furthermore, Kantek and Gezer (2009) reported that the nursing students often use integrating conflict resolution styles as collaborating.

The present study results revealed a statistically significant difference in the predominantly used conflict management strategies among the two study groups. As the second strategy after collaborating, Egyptian students had more

preference to accommodating strategy, while Lebanese ones preferred the competing strategy, followed by the avoiding one, which was the lowest among Egyptians. These differences may reflect different cultures and norms, with more assertiveness among Lebanese students. Thus, Lebanese have more preference to the two extreme strategies, whereas Egyptians prefer the moderation style. These differences reflect the variations in cultures as also demonstrated in comparison with other studies. For instance, Kantek and Gezer (2009) reported that Turkish university nursing students prefer to use the compromising style secondary to collaborating. This compromising style is one of the least in the present study.

The higher use of accommodating strategy among Egyptians is in congruence with Shazly et al. (2005) who similarly showed that accommodating was the second choice among Egyptian nurse interns. Their least preference to avoiding style also goes in line with Rahim et al. (2000) who indicated that avoiding style was the least preferred strategy among nursing students.

Concerning the relation between the types of conflict and conflict resolution strategies, the present study demonstrated no correlations between the accommodating style and any of the four types of conflict, which means that this strategy has no effect on conflict perception by students. On the other hand, the competing, compromising, and avoiding strategies have positive correlations with all types of conflict in the Egyptian group, which means that these strategies are associated with higher levels of the four types. Meanwhile, a negative correlation was found between the competing strategy and the inter-person type of conflict in the Lebanese data, which means that the use of this strategy is associated with lower perception of this type of conflict. As for the collaborating strategy, it seems to have a lowering effect on the intra-group conflict in the two groups, and on the inter-person type in the Lebanese group. These findings indicate the merits of the collaborating strategy in intra-group and inter-person types of conflict. They also demonstrate that the competing strategy may be successful in the inter-person type of conflict among the Lebanese group, while in the Egyptian group it might increase the conflict. However, given the cross-sectional design of the study, no temporal relationship can be deduced between conflict types and conflict strategies. Therefore, it is not known whether it is the type of conflict that dictates the strategy to be used, or is it the strategy used that affects the perception of the conflict type.

As for the relationship between of students' age and academic year on their scores of conflict

resolution strategies, the present study showed that the scores of compromising and avoiding increased with age and academic year of Egyptian students, and the competing increased with their academic year. Meanwhile, no relations were revealed in the Lebanese sample. These findings might be explained by the increasing leniency among students as they grow up in age and academic level, with more tendency towards soothing or avoiding approaches. Meanwhile, the competition increases as they advance in academic level. Seren and Ustun (2008) had similar findings and attributed them to the more emphasis given to communication skills in the early study years of the nursing curriculum.

## 5. Conclusion and recommendations

The study findings provide preliminary evidence of significant differences in the causes and types of conflict, as well as the resolution strategies between Egyptian and Lebanese group of nursing students. Egyptian students have higher prevalence, and prefer moderation in resolution, while Lebanese prefer the two extreme strategies. Thus, based on the study findings, it recommended that the faculty staff reinforce a collaborative approach in minimizing causes of conflict as well as in resolving conflict through rules, regulation and coordination within the faculty and its departments. Keeping personal and professional communication in two- ways channels between faculty and students. Also prospective follow up studies are recommended to observe the students' actual behavior in solving conflict to indicate temporal relationship between conflict types and conflict strategies the same as for the relationship between of students' age, academic year and their conflict resolution strategies. To our knowledge, this study is the first addressing the influence of culture and ethnicity on conflict types and resolution strategies. So further research is needed to assess this influence using more widely different cultures. Such research would help nursing educationalists to tailor training programs in communication and conflict resolution to suit culture and ethnicity.

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#### Clinical resources

<http://www.managementhelp.org>  
<http://www.foundationcoalation.org/publication/conflict.pdf>  
<http://www.irbdirekt.de/daten/iconda/CIB12148.pdf>  
[http://www.ssi.nrcs.usda.gov/publications/\\_borders/1\\_PPCs/PPC012\\_pdf.ConflictManagement.pdf](http://www.ssi.nrcs.usda.gov/publications/_borders/1_PPCs/PPC012_pdf.ConflictManagement.pdf)

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## Field Survey on Most Common Medicinal and Surgical Diseases in Police Guard and Explosive Dogs from 11/ 2007- 2/ 2010

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**Abstract:** Medicinal and surgical diseases are most common health problems in police guard and explosive dogs used for protection of organizations of high economic importance and tourism in Egypt. The present study was aimed to calculate the percentage of most common diseases and to evaluate the degree of success for routine management of these problems. The present survey was carried out on 151 dogs resulted in 1229 cases in different body systems from 11/ 2007 to 2/ 2010. These problems arranged according to percentage in descending manner as follow: pruritus (24.8%) which recorded the highest percentage followed by Ticks (16.4%), surgical wounds (9.8%), diarrhea (9.1%), otic pruritus or ear infection (8.5%), vomiting (5.2%), scrotal affections (4.2%), general weakness (3.4%), bone affections (2.6%), respiratory signs (2.4%), ear trauma or ear hematoma (2.12%), fever (2.1%), tail arrada (1.7%), alopecia without itching (1.51%), deaths and euthanasia (1.5%), muscle affections (1.4%), hemorrhage (1.1%), abscesses (0.7%), joint affections (0.5%), eye affections (0.5%), urinary signs (0.2%) and nervous signs (0.08%). Effective nursing plans were designed to minimize and control all these problems.

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**Keywords:** dogs, diseases, gastroenteritis, pruritus, otic, respiratory, lameness, scrotal, wounds, urinary, nervous

### 1. Introduction

Police working dogs' utility and longevity are presumably affected by diseases common to the specific sizes, breeds and functions of these dogs, as well as by procurement standards. Although diseases that affect these dogs have been identified in previous studies in military dogs (Moore et al., 2001), advances in veterinary diagnostic and therapeutic capabilities should correlate with advancing quantity and quality of life for these valuable dogs. Determination of those diseases that shorten a working dog's service life would ideally allow the implementation of preventive medicine and management practices to improve longevity. These police dogs trained for guarding and for detection of explosives in important hotels, hypermarkets; and private and governmental organizations; and international conferences.

There was also zoonotic aspect of some skin affections to human as sarcoptic mange, ringworm and resistant staphylococci which were easily transmissible to contact human (Van Duijkeren et al., 2004).

The most popular signs of gastroenteritis were vomiting and diarrhea which caused by numerous etiologies. Gastroenteritis caused by dietary indiscretion, organophosphorus poisoning, irritable bowel syndrome, hepatobiliary diseases, renal diseases, Canine distemper virus, Corona virus,

Parvo virus, colibacillosis, salmonellosis, campylobacteriosis, *Clostridium perfringens*, *Entamoeba histolytica*, *Blantidium* spp., *Giardia* spp. (Leib and Monroe, 1997).

Respiratory manifestations were commonly seen in groups of dogs as military working dogs (Moore et al., 2001). Predisposing factors played an important role in upper and lower respiratory tract infections as over-crowdness, unhygienic kennels, traveling and over- exertion. Many etiologies incriminated in respiratory diseases as Adeno virus, Canine distemper virus, *Mycoplasma* spp., *Bordetella bronchiseptica* (Leib and Monroe, 1997).

Fibrotic Myopathy is a chronic, progressive disorder of severe muscle contracture and fibrosis. The exact cause is usually unknown. Fibrotic myopathy may result from acute trauma, chronic repetitive trauma, autoimmune disease, drug reactions, infections, neurogenic disorders, and vascular abnormalities. Ischemia secondary to trauma may also lead to fibrosis. Severely damaged muscle undergoes necrosis followed by fibrosis and contracture. Histologically, muscle is replaced by dense, collagenous connective tissue (Trout, 2008).

Osteoarthritis (i.e., DJD) is a syndrome of pathologic changes in diarthrodial or synovial joints accompanied by signs of pain and disability. It develops secondary to trauma, or from application of normal forces on abnormal joints, such as with hip

dysplasia or cranial cruciate ligament disease. Other less common causes include sepsis, prolonged joint immobilization, inflammatory joint disease, or developmental diseases (e.g., OCD) after Trout (2008).

The Causes of conjunctivitis may be infectious agents (Bacteria and other organisms like Gram-positive bacteria: *Staphylococcus* spp., *Bacillus* spp., *Corynebacterium* spp., viruses like canine distemper: nonspecific conjunctivitis during acute disease or parasites like *Thelazia* spp., *Cuterebra* spp., *Dirofilaria* spp. Larvae and systemic infections like *Blastomyces dermatitidis*, *Histoplasma capsulatum* or *Borrelia burgdorferi*). Immune-mediated disorders like atopy, type I hypersensitivity, cell-mediated inflammation or irritative conditions (drying of tissue from exposure or KCS, abnormal hairs: distichia, ectopic cilia, entropion, or trichiasis rubbing on the conjunctival surface, environmental irritants: chemicals, smoke, dust, foreign bodies, trauma or conditions accompanying other ocular diseases: uveitis, episcleritis, glaucoma, or corneal ulceration (Larocca, 2000 and Ring, 2008).

Bacterial UTIs are commonly associated with other primary abnormalities that increase the bladder's susceptibility to infection such as recessed vulva (the vulva is partially hidden by overhanging skin and is not readily visible, this leads to a warm, moist environment for bacteria to grow and ascend to the bladder), urinary cystoliths, bladder catheterization, urinary incontinence, with wicking of bacteria through the urethra from decreased midurethral pressure, diseases that decrease urine specific gravity (hyperadrenocorticism, chronic renal failure, diabetes mellitus, diabetes insipidus) and anatomical abnormalities of the bladder and ureters (urachal diverticulum, ectopic ureter, patent urachus, urachal cyst and detrusor areflexia and hyporeflexia or other neurological abnormalities of the bladder) as reported by Langston (2008).

Nervous signs as convulsions were rare condition in canine practice as it was mostly occurred in unvaccinated puppy in Canine distemper virus, traumatic affections as fractures of skull or spinal cord, epilepsy and spondylosis (Leib and Monroe, 1997).

The most serious and cause of rapid deaths was Gastric dilatation-volvulus. Gastric dilatation-volvulus (GDV) is an acute, life-threatening condition in dogs (one of the most common causes of death in working dogs) characterized by rapid accumulation of gas in the stomach, malposition of the stomach, increased intra-gastric pressure, and circulatory shock. Gastric dilatation is an acute over distension of the stomach with gas, fluid, or ingesta. Gastric volvulus is rotation of the stomach around its

long axis in a clockwise direction (when viewed from the ventro-dorsal perspective), which obstructs outflow of the duodenum and esophagus and compromises the blood supply to the stomach and spleen and subsequent splenomegally (Moore, 2008).

The target of the present field survey was to record the incidence of common medicinal and surgical diseases affecting police working dogs. The purposes of the present study reported here were to determine cause-specific morbidity and mortality rates and causes of death or reasons for euthanasia in these dogs. Also the present investigation was aimed to identify any apparent breed predispositions and to determine the most important causes of diseases and to identify potential interventions that could reduce the incidence of these recorded diseases.

## 2. Materials and Methods:

A total number of 151 guard and explosive dogs in K9 police center- police officers insurance fund were thoroughly examined; and age, breed and sex were recorded in table 1. Medical history of previous treatments and routine health care, such as deworming and vaccination programs was recorded. All investigated dogs were vaccinated and received Drontal® plus (50 mg praziquantel, 150 mg Febantel, 144 mg pyrantel- Embonat, made in Germany by Bayer) as internal worm prophylaxis. Clinical examination was performed by inspection and recording of different clinical signs and physical examination was also performed (Leib and Monroee, 1997) .

Skin scrapings performed for all examined dogs manifested dermatological lesions as mentioned by Leib and Monroee (1997). Fecal concentration floatation was performed to exclude nematodes and cestodes as described by Thiopont et al. (1986). Hypoallergenic (Elimination) dietary trial was performed to identify an adverse reaction to food as directed by Leib and Monroee (1997).

X-ray and ultrasonographic examinations were performed in department of Surgery, Anesthesiology and Radiology, Faculty of Vet. Med., Cairo University, Giza, Egypt. Seven dogs underwent chest radiography, they were not sedated; and a ventro-dorsal and a right lateral view were performed according to Kirschvink et al, 2006. Ultrasonography was performed to 10 dogs after 24 hrs fasting. The examined dogs were positioned in dorsal recumbency. Cranial ventral abdomen were clipped and sheaved then covered with coupling gel. Transverse and longitudinal scans were taken using Toshiba Scanner (Japan) with alternating frequency convex transducer of 5.0-7.5 MHz according to the method described by Nyland et al., (1989).

**Table (1): Total numbers, breed and specialties of the police working dogs under the survey in K9 center.**

Specialty \ Breed	German shepherd			Malino			Labrador			Golden retriever			Rottweiler			Total Number		
			Total			Total			Total			Total			Total			Total
Explosives	64	5	69	9	4	13	8	3	11	2	2	4	2	1	3	86	15	100
Guards	3	-	3	1	-	1	-	-	-	-	-	-	-	-	-	3	1	4
Breeding	-	3	3	-	2	2	-	2	2	-	1	1	1	3	4	1	11	12
Prepared	9	1	10	-	1	1	-	-	-	-	-	-	-	-	-	9	2	11
Newly entered	23	1	24	-	-	-	-	-	-	-	-	-	-	-	-	23	1	24
Total	99	10	109	10	7	17	8	5	13	2	3	5	3	4	7	122	30	151

A national questionnaire-based study was conducted to identify the incidence of common diseases, and circumstances of trauma affecting

police working dogs in a period between November 2007 and February 2010. All recorded data collected in the designed table (2).

**Table (2): The most common affections and numbers of affected dogs and their breeds in the period between 11/2007 and 2/2010:**

Breeds	Skin					GIT		Respiratory	Musculoskeletal			Eye	Ear		General			Tail	Scrotal affections	Urinary	Nervous	Dead & euthanasia	Total
	Wound	Abscess	Pruritus	Alopecia	Ticks	Vomiting	Diarrhea		Muscle	Bone	Joint		Infection	Trauma	Weakness	Hemorrhage	Fever						
German shepherd																							
Malino																							
Rottweiler																							
Golden Retriever																							
Labrador Retriever																							
Total																							

### 3. Results

The results recorded in table 3. Skin affections (654 out of 1229-53.21%) recorded the highest proportion in police working dogs (Fig I 2, 3, 4 and 5). The manifestations and affections of skin consisted of pruritus (305 out of 1229- 24.8%), ticks (201 out of 1229- 16.4%), wounds (121 out of 1229- 9.8%, Fig. I, 7), alopecia (19 out of 1229- 1.54%) and abscesses (8 out of 1229- 0.7%). Wounds represented 9.8% in the present survey which revealed that incised form (46 out of 121- 38%) recorded the higher incidence among the cases affected with wounds followed by ulcerating (24 out of 121- 19.8%), granulating (17 out of 121- 14%), lacerated (14 out of 121- 11.7%), contusions (8 out of 121- 6.6%), abrasion (7 out of 121- 5.8%), then penetrating (5 out of 121- 4.1%) while abscesses were represented by 0.7%. Alopecia attributed to infestation by internal worms (4 cases of *Dipylidium caninum* (Fig. II-2 & 3), 5 cases of *Toxocara canis* in

puppies (Fig. II-1), one case of *Toxascaris leonina* in puppies) detected during fecal examination, 5 emaciated cases with malnutrition without other detectable causes and 2 cases of ringworm. Gastroenteritis (177 out of 1229- 14.3%) represented the second common problem in police working dogs which manifested by vomiting (64 out of 1229- 5.2%) and diarrhea (113 out of 1229- 9.1%, Fig. I-1). Clinical examination revealed hypermotility (increased peristaltic movements or borborygmal sounds). Respiratory manifestations (29 out of 1229- 2.4%) were the third problem. Respiratory problems consisted of upper respiratory tract infections (22 out of 29- 76%) and lower respiratory tract infections (7 out of 29- 24%). Upper respiratory tract infections manifested by sneezing, serous to mucoid nasal discharge, inspiratory dyspnea, moist coughing and ocular discharge while lower respiratory tract infections marked by mucopurulent nasal discharge, progressive coughing, expiratory dyspnea (with

severely extended head and neck) and systemic reaction (anorexia, lethargy and fever). Respiratory problems were commonly occurred in cold season in winter (27 out of 29- 93%) and the rest of cases in spring (2 out of 29- 7%). Musculoskeletal affections (36 out of 1229- 4.5%) showed lameness and recumbency (3 cases). These cases showed affections in muscle, bone and joints. There were 10 cases suffering from muscle affections. The main affection of the muscle was chronic fibrotic myopathy (8 cases) which occurred as complication to deep wounds (5 cases), chronic debilitating diseases (2 cases) and deep abscess (one case). Bacterial myositis was recorded in 2 cases as secondary to punctured wounds. Dogs suffering from bone affections were 22 cases. Fracture was recorded in 9 cases, varied between metacarpal fracture (4cases), femoral fracture (3 cases) and metatarsal fracture (2 cases). Panostitis was reported in 8 cases. These dogs were aged between six to nine months (offspring of the k-9 center). Osteomyelitis (bone infection) was recorded in 5 dogs as complication to deep wounds. Four dogs were recorded with joint affections. Three of them showed DJD and one case showed sprain (Fig. IV, 5). Eye affections (6 out of 1229- 0.5%) manifested mainly by ocular discharge. Ear affections (132 out of 1229- 10.62%) consisted from ear infections characterized by otic pruritus and purulent ear discharge and ear trauma or aural hematoma (Fig. I- 8) manifested by swelling of ear pinna. General conditions (82 out of 1229- 6.6%) constituted of general weakness with emaciation (43 out of 1229- 3.4%), high fever (26 out of 1229- 2.1%) ranged from 39.8 to 41.3°C and hemorrhage (13 out of 1229- 1.1%). Tail affections (21 out of 1229- 1.7%) displayed signs of pyoderma in 6 cases and tail arrada in 15 cases. Scrotal affections (52 out of 1229- 4.2%, Fig.I- 9) showed thickening of scrotal skin and

purulent exudates with very offensive odor. Urinary problems (2 out of 1229- 0.2%) consisted of case of nephrosis and case of cystitis in female detected by palpation. Nervous signs (1 out of 1229- 0.08%) displayed chorea and respiratory signs in a preparatory puppy.

Skin scraping revealed one case of *Demodex* and 3 cases of *Sarcoptes* spp.. Fecal examination detected macroscopically and microscopically 4 cases of *Dipylidium caninum*, 5 cases of *Toxocara canis* in puppies, one case of *Toxascaris leonina*. Hypoallergenic diet trial detected 8 cases of food allergy. X-ray confirmed cases of pneumonia and also detected their types as diffuse interstitial pneumonia (one case, Fig. IV- 2), lobar pneumonia (2 cases, Fig. IV- 3), or lobular pneumonia (4 cases, Fig. IV- 4). Also radiography detected one case of severe gastric dilatation prior to death (Fig. I- 6 & Fig. IV- 1). Ultrasonography diagnosed one case of chronic nephritis & chronic hepatitis (Fig. II-1), 7 cases of chronic hepatitis in dogs manifested diarrhea and vomiting (Fig. II-2), one case of hepatic cirrhosis (Fig. II-3) and one case of cystitis.

1-3.8 Ys old German shepherd dog suffered from profuse watery diarrhea and lethargy. 2-7 months old German shepherd puppy displayed fleas and alopecia in ventral abdomen. 3- 8.4 Ys old German shepherd showed alopecia and excoriations on back (food allergy). 4- 4.9 Ys old German shepherd manifested by redness, patchy alopecia and crusts around nostrils (Demodicosis detected microscopically). 5-3.2 Ys old German shepherd dog suffered from patchy alopecia and crust (pyoderma). 6-Gross postmortum findings of 5.3 Ys old German shepherd dog displayed gastric dilatation and splenomegally (Gastric dilatation- volvulus).

Table (3): The most common affections and numbers of affected dogs and their breeds in the period between 11/2007 and 2/2010:

Breeds	Skin					GIT		Respiratory	Musculo-skeletal			Eye	Ear		General			Tail	Scrotal affections	Urinary	Nervous	Deaths & euthanasia	Total
	Wounds	Abscess	Pruritus	Alopecia	Ticks	Vomiting	Diarrhea		Muscle	Bone	Joint		Infection	Trauma	Weakness	Hemorrhage	Fever						
German shepherd	61	3	181	7	78	39	81	18	10	22	4	4	71	14	25	10	11	9	27	2	1	11	689
Malino	18	0	31	2	21	8	4	3	5	6	0	2	10	7	2	0	2	12	12	0	0	1	146
Rottweiler	7	0	26	1	17	2	7	1	0	2	0	0	4	1	6	1	4	0	2	0	0	1	82
Golden Retriever	5	0	24	1	23	4	8	2	2	0	0	0	6	1	1	0	3	0	1	0	0	2	83
Labrador Retriever	30	5	43	8	62	11	13	5	0	2	2	0	14	4	9	2	6	0	10	0	0	3	229
Total	121	8	305	19	201	64	113	29	17	32	6	6	105	27	43	13	26	21	52	2	1	18	1229
Percentage (%)	9.8	0.7	24.8	1.54	16.4	5.2	9.1	2.4	1.4	2.6	0.5	0.5	8.5	2.12	3.4	1.1	2.1	1.7	4.2	0.2	0.08	1.5	



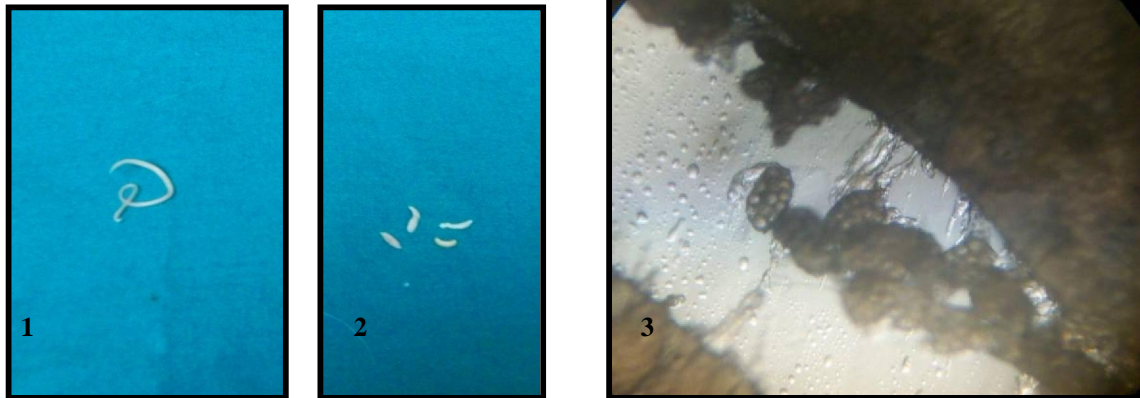
**Figures (I): Different working dogs suffered from most common diseases:**





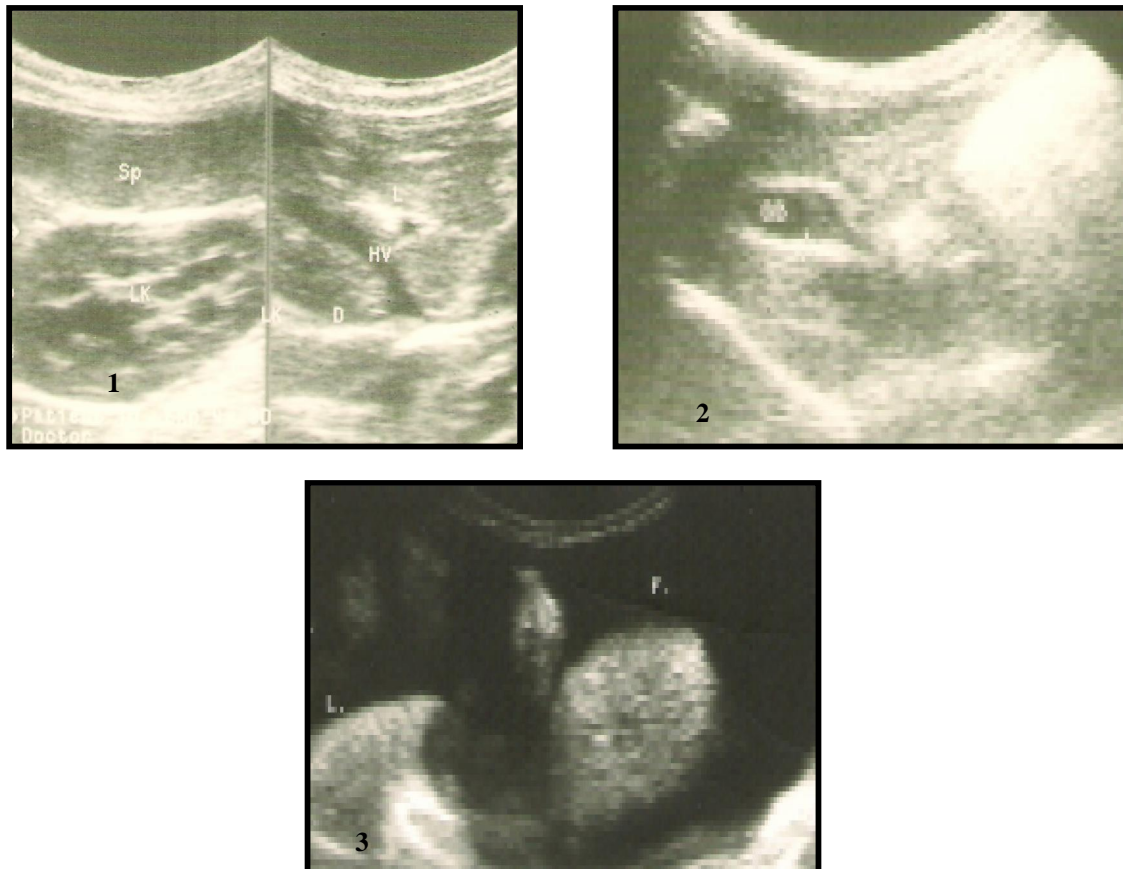
7-Ys old Labrador retriever dog showed external wound in the face under the eye. 8-7.8 Ys old German shepherd dog showed dropped right ear (ear hematoma). 9-4.2 Ys old German shepherd dog displayed thickened inflamed scrotal skin.

**\*Figures (II): Results of fecal examination:**



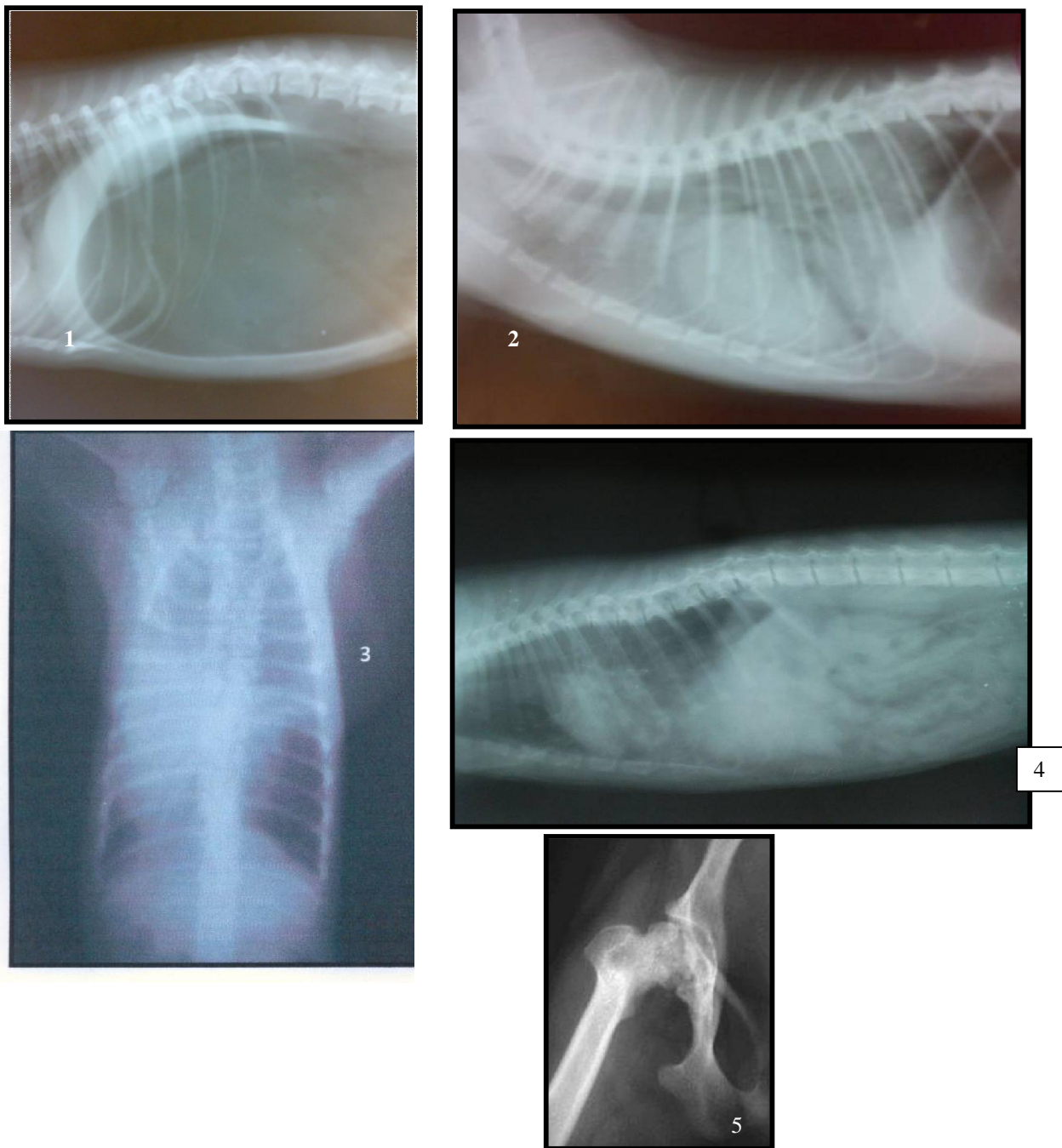
1-Gross fecal examination revealed adult worm of *Toxocara canis* in 9 weeks German shepherd puppy. 2-Gross fecal examination displayed *Dipylidium caninum* gravid segments in 4.7 Ys old German shepherd dog. 3-Microscopical examination of fecal sample in the same German shepherd dog of fig. (II-2) revealed *Dipylidium caninum* egg nest (10X).

**Figures (III): Ultrasonographic findings:**



1-Sagittal double B-scan of liver, left kidney and spleen in 7.9 Ys old German shepherd dog showed the parenchyma of the liver and renal cortex was little bit more echoic than spleen with disclearance of echogenic portal vein walls (chronic nephritis and chronic hepatitis). 2-Hepatic scan of 6.3 Ys old German shepherd bitch revealed marked increase in echogenicity with absence of echogenic walls of portal veins and increased echo-density of gall bladder wall (increased thickness) in chronic hepatitis. 3-Hepatic scan of 8.2 Ys old German shepherd dog revealed marked increase in echogenicity, clear sublobes of the liver and ascetic fluid (hepatic cirrhosis).

**\*Figures (IV): Radiographic findings:**



1-Lateral radiograph of 6.9 Ys old German shepherd dog suffering of gastric dilatation and volvulus showed severe distention of the stomach and aerophagia. 2-Lateral radiograph of the thorax of 3.5 Ys old Labrador retriever bitch suffering of pneumonia showed diffused radio-opaque patches of the cranial, middle and caudal lobes of the lung

(diffused interstitial pneumonia). 3- Ventro-dorsal radiograph of the thorax of 5.6 Ys old German shepherd suffering of pneumonia showed diffused radio-opaque patches of the cranial and middle lobes of the lung (lobar pneumonia). 4- Lateral radiograph of the thorax of 2.8 Ys old German shepherd suffering of pneumonia showed focal radio-opaque patches of the middle lobes of the lung (lobular pneumonia). 5- X-ray of 7.5 Ys German shepherd dog suffered from osteoarthritis (DJD).

#### 4. Discussion

The zoonotic importance of diseases of dogs and the high value and price of these well trained dogs under our field investigation ensured thorough research work-up of each individual problem to perform a strategic plan to decrease incidence of these diseases and to save life of these valuable dogs.

Skin affections (654 out of 1229-53.21%) constituted the highest proportion in police working dogs. The manifestations and affections of skin consisted of pruritus (305 out of 1229- 16.4%), Ticks (201 out of 1229- 16.4%), wounds (121 out of 1229- 9.8%), alopecia (19 out of 1229- 1.54%) and abscesses (8 out of 1229- 0.7%). Pruritus recorded the highest percentage in our field survey. It attributed to numerous etiologies as allergic conditions (flea allergic dermatitis, atopy, food allergy and contact allergic dermatitis), pyoderma (surface, superficial and deep pyoderma), sarcoptic and demodectic mange. Food allergy detected and managed by hypoallergenic diet (8 cases). Ticks recorded an increased incidence during summer, autumn and spring (193 out of 201- 96%) but recorded very low incidence in winter (8 out of 201- 4%). It was recommended to use alternative methods as ultrasonic apparatus which used to repel ticks and weekly dipping of dogs by different acaricidal solutions and firing of walls. Faires et al. (2010) recorded that Methicillin resistance (MR) in recurrent pyoderma is an increasingly important problem in staphylococci and choice of suitable antibacterial to combat it, needs further investigations. Wounds represented 9.8% in the present survey which revealed that incised form (46 out of 121- 38%) recorded the higher incidence among the cases affected with wounds followed by ulcerating (24 out of 121- 19.8%), granulating (17 out of 121- 14%), lacerated (14 out of 121- 11.7%), contusions (8 out of 121- 6.6%), abrasion (7 out of 121- 5.8%), then penetrating (5 out of 121- 4.1%) while abscesses were represented by 0.7%. The low % of the some recorded cases surgical wounds was attributed to the ill developed signs of these forms of wounds, so they did not get attention of the dog trainer (Boden, 2005). The higher incidence of the traumatic injuries among working dogs may be due to the heavy duty and efforts which faced by those dogs. The results from the present study revealed that incised form (38 %) recorded the higher incidence among the cases affected with wounds which may be due to trauma

during transportation of the dogs from the kennel to the site of work. Alopecia in the present survey attributed to infestation by internal worms (4 cases of *Dipylidium caninum*, 5 cases of *Toxocara canis* in puppies, one case of *Toxascaris leonina* in puppies) detected during fecal examination, 5 emaciated cases with malnutrition without other detectable causes and 2 cases of ringworm which detected during skin scraping. Internal worms as a cause of alopecia were of very low % as the effective control measures by the use of broad spectrum anthelmintic Drontal® every 3 months (Leib and Monroee, 1997).

Gastroenteritis (177 out of 1229- 14.3%) represented the second common problem in police working dogs which manifested by vomiting (64 out of 1229- 5.2%) and diarrhea (113 out of 1229- 9.1%). Perhaps the greatest single cause of diarrhea is a change of diet. Thus, a dog that has been used to eating a commercial brand dog food and is suddenly given table scrapes is very likely to suffer diarrhea. It was detected and solved by the use of hypoallergenic diet within 6- 8 weeks in our work-up (94 cases) which was detected the offending commercial dry food. Abrupt changes in diet are particularly distressing to puppies whose intestinal tracts are still very sensitive. Summer is also the season of another serious source of diarrhea – spoiled food. Our investigation recommended being cautious of moist food that becomes moldy. Dietary therapeutic management was instituted taking into account all these consideration. The general protocol was as follows. Other causes of vomiting and diarrhea were detected by other investigations as ultrasonography which detected 7 cases of chronic hepatitis and one case of hepatic cirrhosis. Treatment was generally begun with a 24-48 hour fast (Leib and Monroee, 1997 and Cave et al., 2009). The rest of cases was diagnosed as undifferentiated cases of gastroenteritis and responded in a good manner to symptomatic treatment.

Respiratory manifestations (29 out of 1229- 2.4%) were the third problem. Respiratory problems consisted of upper respiratory tract infections (22 out of 29- 76%) and lower respiratory tract infections (7 out of 29- 24%) which confirmed by radiography. Upper respiratory tract infections manifested by sneezing, serous to mucoid nasal discharge, inspiratory dyspnea, moist coughing and ocular discharge while lower respiratory tract infections marked mucopurulent nasal discharge, progressive



coughing, expiratory dyspnea (with severely extended head and neck). Respiratory problems were commonly occurred in cold season in winter (27 out of 29- 93%) and the rest of cases in spring (2 out of 29- 7%). This recorded incidence of respiratory diseases in cold season as dogs exposed to faulty system of working. This faulty system planned to work the dogs an hour outside the hotels and hypermarkets then kept indoor for rest an hour and released suddenly again outdoor to chilly and sometimes rainy environment and so on. These factors predisposed the working dogs to infection attributed to destruction of the respiratory clearance mechanisms. These predisposing factors also reported by Leib and Monroe (1997) and Eldredge (2007).

Musculoskeletal affections (36 out of 1229- 4.5%) showed lameness and recumbency in 3 cases. The causes may attributed to myositis or degenerative joint diseases or bone affections. Bacterial Myositis may be focal myositis arisen from direct infection of traumatized and devitalized muscle and often associated with contamination of a wound or may result from injection of bacteria into muscle (bite wounds). Myositis may develop from hematogenous infections also as reported by Trout (2008). Osteoarthritis (i.e., DJD) is a syndrome of pathologic changes in diarthrodial or synovial joints accompanied by signs of pain and disability. It developed secondary to trauma, or from application of normal forces on abnormal joints, such as with hip dysplasia or cranial cruciate ligament disease. Other less common causes include sepsis, prolonged joint immobilization, inflammatory joint disease, or developmental diseases (e.g., OCD) after Trout (2008).

Eye affections (6 out of 1229- 0.5%) manifested mainly by ocular discharge. Pannus keratitis may be the principal cause which characterized by infiltration of the cornea with lymphocytes, plasma cells, neutrophils, melanocytes, and granulation tissue. It was also known as *chronic superficial keratitis* or *Ueberreiter's syndrome* (Ring, 2008). Atypical pannus, or plasmoma, is a variation of pannus involving the third eyelid, thought to be immunemediated. Breed predisposition was German shepherd dog (primarily) and other herding dogs: Golden retriever and Rottweiler (Moore, 1999). Superficial erosion also may be the second common cause which is a loss of the corneal epithelium only while stromal ulceration (Corneal Ulceration) involved loss of both the epithelium and some portion of stroma (with a descemetocoele, stroma is lost down to Descemet's membrane or perforation in which there is a wound in Descemet's membrane, with leakage of aqueous humor and/or iris prolapsed

(Ring, 2008). The main cause was trauma (External sources: cat scratch, foreign body, or eyelid disease: distichiasis, ectopic cilia, entropion. The other causes are tear film disease like Keratoconjunctivitis sicca (KCS), Goblet cell deficiency or Lipid tear film abnormality from meibomian gland pathology (Moore, 1999). Also Exophthalmos (pathologic or conformational) and decreased blink frequency (It may occur from corneal denervation after trigeminal nerve injury or Brachycephalic dogs have relatively few corneal nerves and often an incomplete blink) may be involved. Other causes of corneal ulcer are infections: bacterial (Tolar et al., 2006), fungal: aspergillosis (Marlar et al., 1994) or viral: FHV, thermal or chemical burns, immune-mediated disease: marginal keratitis and secondary to other corneal disease like calcium infiltrates, edema (especially bullous keratopathy) or corneal epithelial basement membrane disorder.

Ear affections (132 out of 1229- 10.62%) consisted from ear infections characterized by otic pruritus and purulent ear discharge and ear trauma or aural hematoma manifested by swelling of ear pinna. This agreed with Gotthelf (2005) who said that aural hematoma is uncommon findings in chronic skin diseases and many dogs affected with aural hematoma did not have signs of any concurrent auricular, cutaneous or systemic disease.

General conditions (82 out of 1229- 6.6%) constituted of general weakness with emaciation (43 out of 1229- 3.4%), high fever (26 out of 1229- 2.1%) ranged from 39.8 to 41.3°C and hemorrhage (13 out of 1229- 1.1%). General weakness or overexertion was attributed to long time of working hours which may reached in some explosive German shepherd to over 12 hours. High fever attributed to numerous etiologies but some cases previously infested by ticks may resulted from infection by *Ehrlichia* or *Babesia* which need further investigations. Cases of hemorrhage mostly attributed to trauma or fights. These findings also recorded by Leib and Monroe (1997) and Eldrege (2007).

Tail affections (21 out of 1229- 1.7%) displayed signs of pyoderma in 6 cases and tail arrada in 15 cases. It need a massive medicinal therapeutic approach in cases of pyoderma and surgical intervention in cases of tail arrada. Weekly cleaning and rinsing resulted in obvious decrease in % of these problems as recorded by Fossum et al. (2002).

Scrotal affections (52 out of 1229- 4.2%) showed thickening of scrotal skin purulent exudates with very offensive odor. Weekly cleaning and rinsing and wide space resulted in a marked decrease in incidence of these affections as recorded by Fossum et al. (2002).

Urinary problems (2 out of 1229- 0.2%) consisted of case of chronic nephritis and case of cystitis in bitch. They were attributed to one case of chronic nephritis and the other case of cystitis which were detected by ultrasonography. These cases advised to be treated massively to prevent the further chronic renal failure (Freitag et al., 2006).

Nervous signs (1 out of 1229- 0.08%) displayed chorea and respiratory signs in a preparatory puppy. Unvaccinated preparatory puppy was attributed as it matched with signs recorded by Leib and Monroe (1997)

Death and euthanasia were recorded in 18 cases. Nine cases died (four cases were suffering from gastric dilation and volvulus, three were suffering from senility and two cases suffering from heart attack diagnosed by auscultation of heart murmurs antemortum). Nine dogs were euthanized, 6 cases showed chronic osteoarthritis (DJD), 2 cases suffering from general weakness and one case suffering from chronic hepatitis.. The first cause was GDV (gastric dilatation volvulus) in 4 cases. The true cause of GDV is unknown and overall prevalence in the general dog population is low. Middle-aged to older, large- and giant-breed, deep-chested dogs are at greatest risk; however, GDV has also been reported in small breeds (e.g., dachshund, basset hound, pug) and the cat (rare) (Moore, 2008). A combination of environmental, anatomical, physiological, and pathologic risk factors include (Rasmussen, 2003; Glickman et al., 2000) increased risk in large- and giant-breed dogs, dogs with a first-degree relative with a history of GDV, large, thoracic, depth-to-width ratio (deep-chested), lean body condition, age, behaviors that promote aerophagia, eating from a raised food bowl, stress and nervous temperament, feeding a large volume of food per meal (Raghavan et al., 2004), feeding of dry foods containing a fat or oil in the first four listed ingredients (Raghavan et al., 2006) and pyloric outflow obstruction. One case was confirmed with plain x-ray film. These cases died within 12 hours and reported as dead cases. Postmortem examination confirmed the diagnosis as it showed rotation of the stomach around its long axis in a clockwise direction and congestion of the spleen. The causes of GDV were unclear and overall prevalence in the dog population was low which agree with Moore (2008). All cases were recorded in male German shepherd dogs with age between three to six years which parallel to findings of Moore (2008)

Cave et al. (2009) recorded in a survey of diseases of working farm dogs in New Zealand that trauma was identified as a cause of injury in 848 (38%) visits. Huntaways dogs were apparently over-represented in cases of constipation, gastric

dilatation-volvulus (GDV), theriogenological problems, laryngitis, hip dysplasia, and degenerative lumbosacral disease. In contrast, Heading dogs were over-represented among cases of multiple ligamentous injury of the stifle, disruption of the gastrocnemius or Achilles tendon, tarsal injuries, and hip luxation. Traumatic injury involved injury by stock (20%), automotive incidents (19%), transit across fence lines (16%), and dog bites (12%). Loss occurred following 10% of visits, of which trauma was known to be involved in 32%. The most important non-traumatic causes of loss were GDV, degenerative joint disease, mammary neoplasia and diseases involving the female reproductive tract, cardiac disease, and poisoning

Our field investigation was concluded that there were 21 recorded signs in different body systems and deaths. These problems arranged according to percentage in descending manner as follow: pruritus (24.8%) which recorded the highest percentage followed by Ticks (16.4%), surgical wounds (9.8%), diarrhea (9.1%), otic pruritus (8.5%), vomiting (5.2%), scrotal affections (4.2%), general weakness (3.4%), bone affections (2.6%), respiratory signs (2.4%), ear swellings or ear hematoma (2.12%), fever (2.1%), tail arrada (1.7%), alopecia without itching (1.51%), deaths (1.5%), muscle affections (1.4%), hemorrhage (1.1%), abscesses (0.7%), joint affections (0.5%), eye affections (0.5%), urinary signs (0.2%), nervous signs (0.08%).

## 5. Conclusion

Medicinal and surgical diseases in guard and explosive dogs are common health problems. The present survey was succeeded to direct the efforts to control serious and common diseases which affect life of these valuable dogs and health of human. It was recommended to make an strategic plan to each individual problem and also to do every effort by further thorough investigations to compate unsolved problems. Kennels, transmitting vehicles if repaired and fights if prevented; surgical wounds, ear hematoma, otitis externa, musculoskeletal affections and eye affections will be minimized. Wide space in transmitting vehicles and hygienic kennels were advised to reduce percentage of scrotal affections. It was advised further thorough investigation in skin affections as huge percentage to select an effective therapeutic plan.

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## ii-Preliminary Study in Diagnosis and Early Prediction of Preeclampsia by Using FTIR Spectroscopy Technique

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**Abstract:** Preeclampsia is a heterogeneous condition, potentially involving several separate pathophysiological pathways; currently no clinical screening test is useful for prediction of preeclampsia development. Fourier-transform infrared spectroscopy (FTIR) holds great promise for clinical chemistry measurements. FTIR spectra of plasma samples from pregnant women -14 patients and 31 normotensive were obtained. Second derivative spectra, Kramer Krong refractive index and ANOVA test were tacking in comparison studies. The parameters studied were proteins and lipids. Different absorbance ratios for specific bands were calculated and plotted versus the patient samples. The absorbance IR spectra of these two groups were slightly different, but from the curve fitting analysis, the protein secondary structure compositions were significant different. The decrease in  $\alpha$ -helix structure due to oxidative stress in patient group might be responsible of the dramatic increase in  $\beta$ -turns and unordered structure. Moreover, the peaks present in the IR second derivative, for patient group, at  $1744\text{cm}^{-1}$  (cholesterol and triglycerides ester C=O),  $1710\text{cm}^{-1}$  (carbonyl C-O stretch), and  $1621\text{cm}^{-1}$  (peptide C=O stretch) positively correlated with low density lipoprotein (LDL) oxidation. The results showed that among the normotensive control group three subjects later developed preeclampsia. Normotensive pregnant women who developed preeclampsia were considered as subjects at high risk. This study suggests, for the first time that FT-IR spectroscopy can be successfully used as an accurate and rapid test, for diagnosis and confirmed with 33% confidence level early prediction of preeclampsia, starting from 20 week of gestation.

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**Keywords:** Fourier Transform Infrared Spectroscopy (FTIR); Oxidative Stress; Dyslipidemia; Preeclampsia; Plasma

**Abbreviations:** Fourier transform infrared spectroscopy (FTIR)

### Introduction

Preeclampsia, which affects 3% to 10% of pregnancies <sup>[1]</sup>, is a pregnancy-specific disorder characterized by hypertension, proteinuria and edema. The efforts to develop screening tests for potential use in clinical practice have yielded disappointing results <sup>[2]</sup>. Markers were generally chosen on the basis of specific pathophysiological abnormalities that have been reported in association with preeclampsia. Maternal concentrations of these biomarkers have been reported to be either increased or reduced early in gestation before the onset of preeclampsia. Given that preeclampsia is likely to be a heterogeneous condition, potentially involving several separate pathophysiological pathways, it is not surprising that simple clinical indicators are ineffective in identifying women who would benefit from pathway-specific treatment <sup>[3]</sup>. A variety of substances indicative of endothelial dysfunction are increased in the blood or urine of women with

preeclampsia <sup>[3, 4-5]</sup>. Many of these substances are elevated weeks before (as well as during) clinically evident preeclampsia <sup>[6,7]</sup>. It has been suggested that preeclampsia is a disease of antioxidant inadequacy appearing when the normal antioxidant balance is upset <sup>[8]</sup>.

During the last decade, Fourier transform infrared (FTIR) spectroscopy has proven and accepted to be a powerful tool for the study of biological samples. The primary reason for this is that common biomolecules such as proteins, nucleic acids, and lipids, have characteristic functional groups having unique molecular vibrational modes (vibrational fingerprints) corresponding to specific infrared light frequencies <sup>[9,10]</sup>. The composition and structure of molecular functional groups can be determined by analyzing the position, width, and intensity of infrared light absorption <sup>[12-16]</sup>.

In this cross sectiona study we have tested FTIR spectroscopy as a potential specific accurate

diagnostic tool for identifying normal pregnancy and preeclampsia. The second objective of this study was to define a new biophysical marker that is simple, valid and rapid, with potentially no limitation in clinical practice for early prediction of women – that are at high risk- who might later develop preeclampsia.

## 2. Materials and methods

This study was approved by the Bioethical and Research Committee at the Faculty of Medicine, King Abdulaziz University (KAU). An oral voluntary consent was obtained from all the participating subjects.

The main focus of this work was to conduct prospective or cross sectional studies aimed at evaluating the feasibility of using a clinical and biophysical test, performed during pregnancy, before the development of preeclampsia.

### Inclusion Criteria:

Cases eligible for inclusion in this study were normotensive pregnant women that have no evidence of proteinuria (control group) and patient group either with mild or severe preeclampsia. Preeclampsia was defined as hypertension (systolic blood pressure 140 mmHg and diastolic blood pressure 90 mmHg after 20 weeks' gestation) and proteinuria (300mg in a 24 hr urine collection or one dipstick measurement of 1+) according to the Committee off Terminology of American College of Obstetricians and Gynecologists (ACOG) definition<sup>[17]</sup>. Severe preeclampsia was diagnosed on the basis of diastolic blood pressure 110 mmHg or significant proteinuria (dipstick measurement of 2+) or the presence of severity evidences such as headache, visual disturbances, upper abdominal pain, oliguria, convulsion, elevated serum creatinine, thrombocytopenia, marked liver enzyme elevation, and pulmonary edema.

### Exclusion criteria:

Included fetal anomalies, chronic heart disease and inflammatory disorders.

### 2.1. Selection of women:

- **Age:** The age of 45 women participating in this study was from 16 to 49 years (mean= 32 years, SD= 7.6).

- **Week of gestation:** All the subjects were in second and third trimester. The gestational age was between 20 to 42 weeks. Data taken from the medical record of subjects are given in Table 1.

- **Study groups:** 31 normotensive pregnant women were taken as control group, and 14 patients diagnosed with preeclampsia were taken as the patients group. All subjects received obstetrical care at KAU hospital.

## 2.2. Blood Collection and plasma separation

Three ml of non-fasting vinous blood were drawn into in vacuon test tubes containing ethylene diamine tetra-acetic acid (EDTA), an anti-clotting agent. The blood was immediately centrifuged at 4000 rpm for 10 min to separate plasma. The plasma was then removed and stored at -80 C. All the samples were first lyophilized prior to FTIR measurements.

## 2.3. Infrared Measurement

The lyophilized samples were dispersed in potassium bromide (KBr) by gently mixing with a pestle in an agate mortar to obtain a homogenous mixture as described in<sup>[14]</sup> but with 1% concentration. The mixture was then pressed in a die at 5 metric tons force for 3 s, creating a 1.1 cm diameter transparent disc with imbedded samples. For each sample, the absorbance of three different FTIR spectra were recorded at room temperature (26 C  $\pm$  1 C) in the mid infrared range (4000-400 cm<sup>-1</sup>) using a Shimadzu FTIR-8400s spectrophotometer with continuous nitrogen purge. Those three spectra were then coadded. Typically, 20 scans were single-averaged for a single spectrum and at spectral resolution of 4 cm<sup>-1</sup>. To minimize the difficulties arising from unavoidable shifts, baseline correction was applied by using IRsolution software. Each spectrum was normalized as normalization produces a spectrum in which maximum value of absorbance becomes 2 and minimum value 0 by using the same software. The parameters studied were proteins and lipids. After baseline correction, the best fit for decomposing the amide I bands in the spectral region of interest was obtained by Gaussian components using OMNIC software.

## 3. Results

### i) IR spectral features and assignments

The infrared spectra were obtained for 45 lyophilized plasma samples from pregnant women, including 31 samples from women clinically and laboratory assessed as healthy normotensive and 14 samples from patients already diagnosed as preeclampsia. Each spectrum was normalized and base line corrected.

This work is a continuous of our previous study on serum samples from the same subjects.<sup>[18]</sup> According to our previous findings based on the IR spectral signatures of serum and the calculated amide A/ Amide B ratio, the control spectra were successfully divided into two groups: control-1 (samples from 15-32) and control-2 (samples from 33-45; subjects are at high risk to develop preeclampsia).<sup>[18]</sup>

For clarity the sum, of equal numbers, of coadded spectra from control-1 samples, the sum of control-2 spectra and the sum of patient spectra are overlaid and shown in (Fig.1).

The main absorption bands in this figure belonging to lipids, proteins, carbohydrates and nucleic acids were defined in detail together with their assignments in Table 1.

Careful examination of the FTIR spectrum obtained from each sample revealed differences in the intensities of the absorption bands in relation to each other among the groups under investigation. It is obvious from Fig. 1 that control-1 & 2 spectra are almost indistinguishable, while the intensity of the entire spectrum of the patient group is markedly decreased compared to control-1 & 2 groups.

The intensity and/or more accurately the area of the absorption bands is directly related to the concentration of the molecules.<sup>[19, 20]</sup>

However, wide overlapping of bands in the raw spectrum causes difficulty in band segregation and their assignment. Hence using raw spectrum in the interpretation of data may not be totally conclusive, since the raw data obtained are often noisy.<sup>[21]</sup> Thus, in the present study, resolving this issue has been done by treating the raw spectrum with Kubelka Munk algorithm and later peak resolved for further interpretation. This method is used here for illustrative purpose only.

An advantage of this method is that the data is de-noised to a great extent.

Comparison of the IR spectra for control-1, control-2 and patient groups causes visualization in the band structure perturbation more distinctly.

Fig. 2 shows the curve-fitted amide I, amide II and esterified bands contour of all the tested groups. The data presented in Table 3 summarize the calculated positions and fractional areas of the amide I component bands from all groups under investigation. The amide I absorption is mainly associated with C=O stretching vibrations. The position of this absorption is sensitive to protein conformation.<sup>[22]</sup>

Table 3 showed a little decrease in  $\alpha$ -helix content (band around 1652 cm<sup>-1</sup>) of amide I band for control-2 in respect to control-1 while there is no such band for patient group. On the other hand there is high content of  $\beta$ -turns and unordered protein secondary structure in patient group curve fitted spectra while there is no such structure in both control-1 and control-2 spectra.

## ii) Second Derivative Analysis

For further analysis, the second derivative spectra of plasma samples were obtained (Fig. 3) The most absorption peaks observed in both esterified

lipid (1750-1700 cm<sup>-1</sup>) and the amide I (1700-1600 cm<sup>-1</sup>) band and their assignment respectively are given in table 4. It is apparent from the Fig. 3(a) and the table that there is significant change in the bands positions and intensities which in turn will affect the plasma lipid profile and the secondary structure of plasma proteins as well.

The C=O stretching band (1739 cm<sup>-1</sup>) is strongly associated with lipids implying that any shift in the frequency of this band can directly correlated with an alteration in the state of intramolecular hydrogen bonding of the interfacial region of the phospholipids structure with water molecules and/or some functional groups of other molecules.<sup>[23]</sup> In the current study, it has been observed that the spectrum of control-1 has an ill resolved bands and shoulders appeared as broad band in the range of 1738 – 1748 cm<sup>-1</sup>. In the control-2 spectrum this band apparently splits into one strong peak at 1741 cm<sup>-1</sup> as well as a strong shoulder at 1748 cm<sup>-1</sup> while in patient spectrum only a strong band centered at 1744 cm<sup>-1</sup> is present. Moreover, the small band at 1710 cm<sup>-1</sup> becomes more intense and sharper in patient spectrum relative to the control-1. Meanwhile, it turned to a very weak shoulder together with the appearance of a new weak band at 1723 cm<sup>-1</sup> in the control-2 spectrum.

Examination of the second derivative spectra in the amide I region (1700-1600 cm<sup>-1</sup>) revealed that the over all plasma protein secondary structure consist mainly of  $\alpha$ -helix and anti parallel  $\beta$ -pleated sheets in control-1 as evident by the strong band centered at 1652 cm<sup>-1</sup> and 1690 cm<sup>-1</sup> respectively. Meanwhile, the main protein secondary structure in control-2 is antiparallel  $\beta$ -pleated sheets and random coil which was evident by the strong band centered at 1690 cm<sup>-1</sup> and 1645 cm<sup>-1</sup> respectively. On the other hand, the protein secondary structure for patient group consist mainly of  $\beta$ -sheets,  $\beta$ -turn and random coil indicated by the strong bands centered at 1687 - 1677 cm<sup>-1</sup>, 1664 and 1641 cm<sup>-1</sup> respectively.

## iii) Refractive Index Measurements:

Additional investigation to the second derivative spectra were performed by using IR solution software in calculating the refractive index (n) by using Kramers Kronig analysis. The (n) values for cholesterol band at 1470 cm<sup>-1</sup> is represented graphically in Fig. 4.

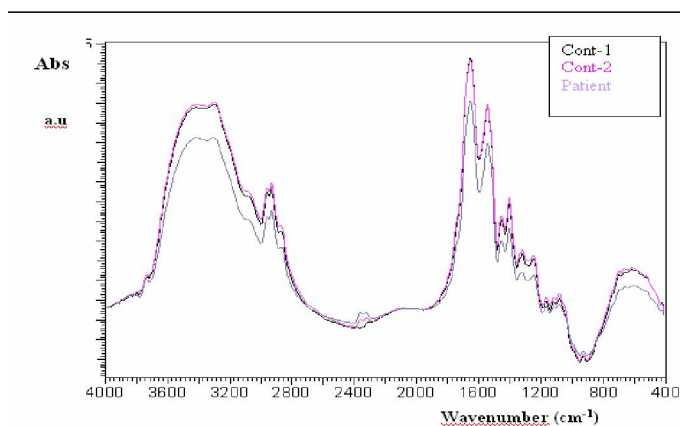
It is observed from the figure that the (n) values of most patient group are always higher >1.32 than control-1 & 2 groups. Moreover, the control-2 group has the lowest (n) values among the tested groups. These results were confirmed by results obtained from ANOVA test.

Comparison between these results and the information given in Table 1 was made and revealed the following:

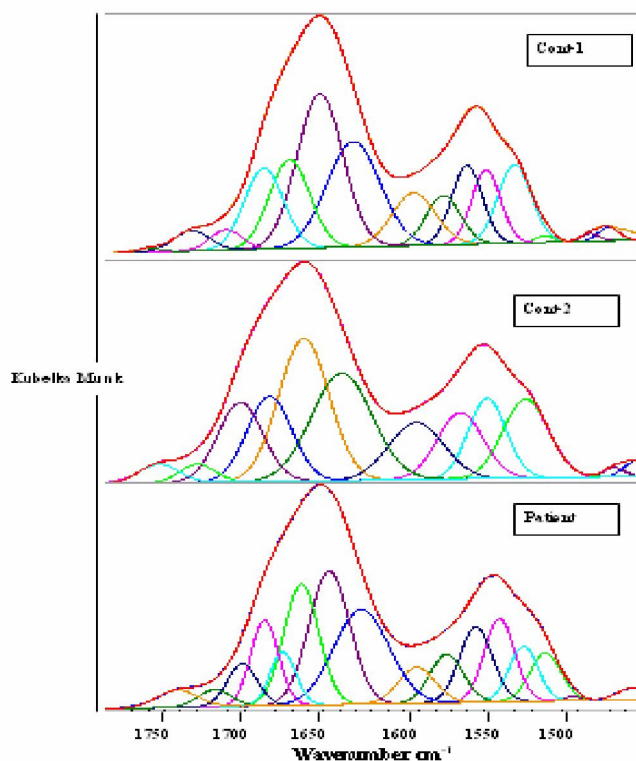
1. The highest (n) value was obtained from patient numbers (1, 4, 6, 8, 10, 11, 12, and 14). They all had high BMI except patient numbers (4, 12), they were the youngest among this group.
2. For control-2 group, which showed the lowest (n) value among the tested groups, the sample

number (34) was exception. This subject developed later preeclampsia.

3. Samples number 35 and 39 also developed preeclampsia, they are 40 and 38 years old and their blood group for both are A<sup>+</sup>, although, they are at different gestational age.

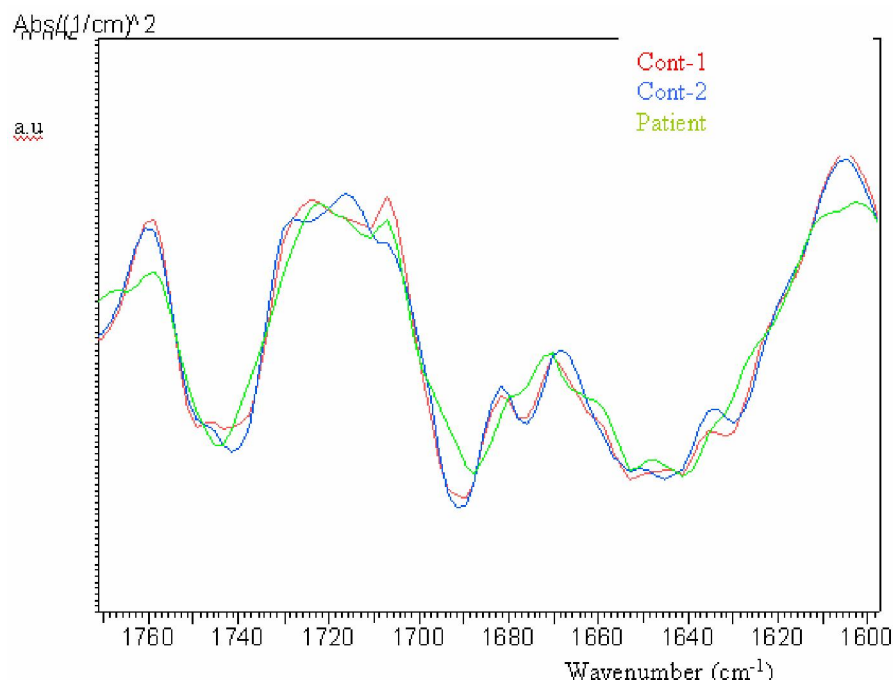


**Fig. 1. FTIR spectra of plasma samples taken from control-1, control-2 and patient groups.**

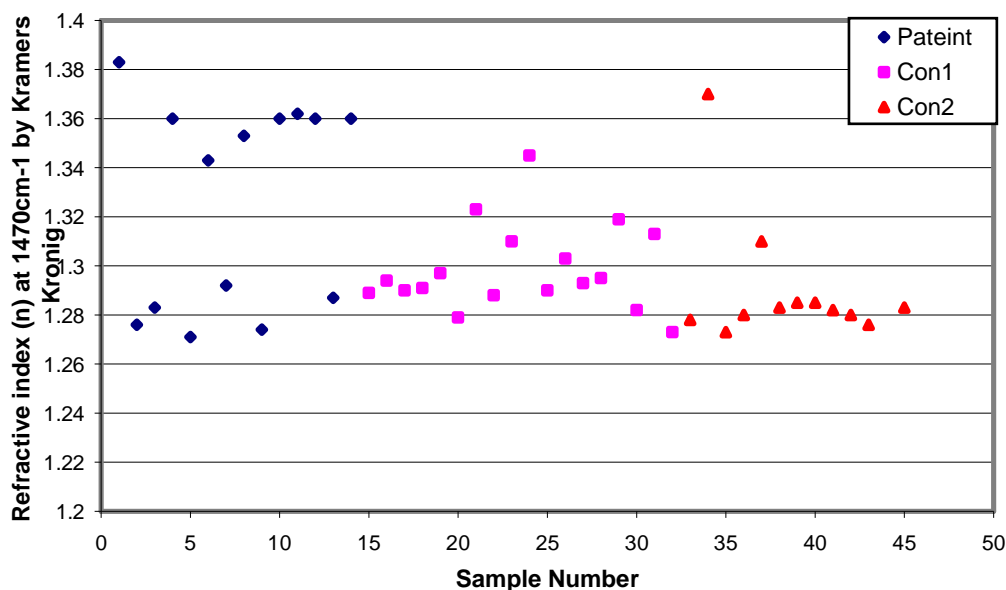


**Fig. 2. Spectral curve-fitting of the 1800-1500 cm<sup>-1</sup> spectral interval of FTIR spectra of plasma samples from control-1, control-2 and patient groups.**





**Fig. 3.** IR second derivative spectra of plasma samples from control-1, control-2 and patient groups in range (1800-1400 cm<sup>-1</sup>). The figure shows the shifts in the band positions and the changes in band intensities for esterified C=O(1750 -1700 cm<sup>-1</sup>) and amide I bands (1700-1600 cm<sup>-1</sup>) among control-1, control-2 and patient groups.



**Fig. 4:** Variation in the refractive index (n) among control-1, control-2 and patient groups in serum samples. The values are the average of three different measurements for each sample the SD ranging from 0.01- 0.008.

**Table 1: General information for subjects given from medical records in KAU hospital.**

Sample No		Gestation Age	Age	Blood Group	BMI	History
Patients	1	42	30	O+	31.3	Mild PET, BP=147/89, protein= 0.12, SVD, fibrinogen, ALP, Neutrophils <b>medication</b> =aldomate 500 mg, adulate 20 mg.
	2	40	26	B+	30.0	Mild PET, BP=155/90,SVD, protein= 1.6, fibrinogen, ALP, Neutrophils, history preeclampsia, BP <b>medication</b> = adalate 20 mg.
	3	38	38	A+	35 .0	Mild PET, BP= 139/84, GDM, hypertension, +ve protein urea, CS (trans lie verse baby).
	4	37	22	O+	24.3	Protein=0.162, BP=140/85, BP, fibrinogen, ALP, Neutrophils, PIH, <b>medication</b> =aldomate 250 mg.
	5	37	43	O+	43.2	BP, FDM, CS (brain aneurysm), LDL, cholesterol, protein= 0.15, ALP, Neutrophils, history preeclampsia, <b>medication</b> =omeprazole, glucophage 75 mg, omperazol, Insulin.
	6	37	43	O+	35.9	Mild PET, BP= 146/90, SVD, fibrinogen, ALP, LDH, history preeclampsia.
	7	37	26	A+	33.9	Mild PET, protein=0.399, BP= 147/85, protein=trace, fibrinogen, ALP, Neutrophils, history preeclampsia <b>medication</b> =omperazol 10 mg, aldomet 250 mg.
	8	36	31	A+	41.2	Mild PET, BP=144/80, 151/76, protein= 0.2, CS, TSH, fibrinogen, LDH, Eosinophils, history preeclampsia <b>medication</b> = thyroxin (hypothyroidism).
	9	35	37	B+	32.9	Mild PET, BP=150/90, protein=0.2, CS, previous PET, fibrinogen, ALP, AST, Neutrophils, <b>medication</b> =adalat 20 mg.
	10	34	27	A+	39.8	previous PET,CS, BP, GDM, <b>medication</b> = aldomet 250 mg.
	11	34	24	B+	36.0	BP= 149/90, 168/105, CS, fibrinogen, ALP, LDH, Neutrophils, <b>medication</b> = heparin, aldomet 500 mg.
	12	34	16	O+	23.9	Mild PET, BP= 146/84, protein= +2, SVD, wince, fibrinogen, ALP, LDH, AST, APTT, <b>medications</b> = adalat, ampicillin1g.
	13	32	26	O+	-	SVD, Neutrophils, fibrinogen, <b>medications</b> = thyroxin.
	14	31	40	A+	36.0	Mild PET, BP= 148/65, protein= 0.28, fibrinogen, ALP, Neutrophils, <b>medications</b> = aldomet 250 mg.
Controls	15	37	37	B+	30.7	BP=115/67, SVD.
	16	37	46	B+	-	BP= 132/76, SVD, fibrinogen, ALP <b>medication</b> = ampicillin1g.
	17	35	25	O+	-	BP= 104/48, CS.
	18	34	24	B+	-	BP= 95/52.
	19	33	29	A+	-	BP= 132/58.
	20	32	38	O+	38.1	BP= 97/63, CS.
	21	32	35	A+	29.8	BP= 117/55.
	22	30	20	A+	28.8	BP= 101/50.
	23	25	28	B+	34.8	BP= 92/56, SVD <b>medication</b> = thyroxin 25 mg (Hypothyroidism).
	24	25	36	O <sup>-</sup>	47.2	BP= 155/77, BP= 132/85, SVD.
	25	25	35	B+	-	BP= 107/57, CS.
	26	25	27	O+	42.8	BP= 102/53, SVD.
	27	24	27	O+	-	BP= 97/63, CS, Neutrophils.
	28	22	29	O+	28.2	BP= 117/55, twins, CS.
	29	22	22	A+	-	BP= 101/50.
	30	20	38	O+	-	BP= 92/56, SVD.
	31	20	36	O+	-	BP= 118/59, SVD.
	32	20	28	B+	-	BP= 100/63, CS.
	33	38	43	O+	27.2	BP= 121/76, SVD, anemia during pregnancy, Neutrophils, ALP <b>medications</b> = Erythromycin 500 mg.
	34	22	21	O+	16.7	BP= 110/56, SVD. TSH, glucose, AST, Neutrophils, Basophils.
35	20	40	A+	33.4	BP= 121/82, CS, Neutrophils, Eosinophils, Fibrinogen, APTT.	

36	20	27	O+	24.7	BP= 90/55, Neutrophils.
37	35	32	B+	-	BP= 113/60, CS.
38	35	33	O+	-	BP= 135/87, GDM, SVD, BP, history with disease.
39	35	38	A+	27.4	BP= 109/59, kidney disease, total protein, posterior vaginal repair.
40	33	38	O+	28.0	BP= 122/78, anemia during pregnancy, SVD.
41	25	28	B+	37.1	BP= 118/74, CS, Eosinophils.
42	25	42	O+	-	BP= 113/75, SVD, hyperglycemia.
43	24	49	O+	-	BP= 139/67, diabetes, history preeclampsia, BP, CS, medications= aldomat.
44	24	31	O+	27.3	BP= 113/66, ALP.
45	21	27	A+	-	BP= 96/63, kidney disease, Neutrophils, Eosinophils, Fibrinogen, APTT.

**Table 2: Major plasma assignments from plasma FT-IR spectra absorption bands.**

Bands (cm <sup>-1</sup> )	Major assignments
3020-3000	(CH): unsaturated fatty acids, cholesterol esters
2990-2950	as(CH <sub>3</sub> ): cholesterol esters, triglycerides
2950-2880	as(CH <sub>2</sub> ): long chain fatty acids, phospholipids
2880-2860	s(CH <sub>3</sub> ): cholesterol esters, triglycerides, glycerol
2870-2830	s(CH <sub>2</sub> ): long chain fatty acids, phospholipids
2996-2819	as(CH <sub>3</sub> ), s(CH <sub>3</sub> ), as(CH <sub>2</sub> ), s(CH <sub>2</sub> ): fatty acids, phospholipids, triglycerides
1739-1732	(C=O): lipid, cholesterol, triglycerides
1720-1600	(C=O): (amide I) -sheet: proteins, turns, coils
1630-1560	(NH <sub>2</sub> ):amino acids
1600-1480	(N-H):(amide II) -helix: proteins
1480-1430	as(CH <sub>3</sub> ), as(CH <sub>2</sub> ), s(CH <sub>3</sub> ), s(CH <sub>2</sub> ): fatty acids, phospholipids, triglycerides
1430-1360	(COO): amino acids
1300-900	(C-O): saccharides, glucose, lactate, glycerol

: stretching vibrations, : bending (scissoring) vibrations, s: symmetric, as: asymmetric. Spectral assignment taken from references [9-12, 15,16].

**Table 3: positions and fractional areas of the amide I component bands for plasma samples taken from control-1, control-2 and patient groups.**

Peak centre (cm <sup>-1</sup> )	Structure	Cont-1	Cont-2	patient
<b>1626.411</b>	<b>-turns</b>	-	-	<b>69.89</b>
1630.022	Parallel -sheets	79.14	83.76	
1646.592	unordered structure	-	-	72.75
<b>1653.095</b>	<b>-helix</b>	<b>99.41</b>	<b>92.78</b>	
<b>1664.177</b>	<b>-turns</b>	-	-	<b>56.54</b>
1674.014	Parallel -sheets	50.71	49.32	18.25
1687.300	-sheets	-	-	31.79
1691.718	Anti-parallel -sheets	44.67	46.22	

Spectral assignment was taken from references [22, 47].

**Table 4: Second derivative component bands of the esterified region 1750-1700cm<sup>-1</sup>.**

Control-1	Control-2	patient	Band assignment	Ref.(Masayuki et al., 2002)
w 1711	w sh 1717	-		vLDL & LDL
w sh 1726	-	w 1725	hydrogen-bonded C=O groups	
m 1738	m 1738	-	Ester C=O	LDL
m 1748	m 1748	s 1741	non-hydrogen bonded ester carbonyl C=O	vLDL

w=weak, sh=shoulder, m=medium, s=strong [42,43]

#### 4. Discussion

It has been suggested that preeclampsia is a disease of antioxidant inadequacy appearing when the normal antioxidant balance is upset.<sup>[8]</sup> Oxidative damage by free radicals or reactive oxygen species (ROS) can result in lipid peroxidation and protein modification [24] causing changes in membrane properties and cell dysfunction.<sup>[25]</sup> The highly reactive primary products of lipid peroxidation, lipid hydroperoxides, are formed when free radicals attack polyunsaturated fatty acids or cholesterol in membrane and lipoproteins. Lipid hydroperoxides function in normal physiology by regulating enzymes and redox-sensitive genes<sup>[26, 27]</sup>. However, uncontrolled lipid peroxidation like in case of preeclampsia can result in cellular dysfunction and damage.<sup>[1, 28, 29]</sup> Such damage, known as oxidative stress, is normally prevented by an extensive and multilayered antioxidant system consisting of both low and high molecular weight components.<sup>[24]</sup>

It was previously suggested that free radical damage can cause a reduction in protein synthesis.<sup>[30]</sup> Albumin may represent the major and predominant circulating antioxidant in plasma [31], which is known to be exposed to continuous oxidative stress<sup>[32]</sup>. Alterations in the structure of albumin may result in impairments of its biological properties<sup>[33]</sup>.

On the bases of the forgoing consideration, one can explain the significant decrease in the protein peaks intensities together with the observed band shifts in plasma samples for patient group compared to control-1 & 2. Thus, a dramatic change in proteins secondary structure takes place which in turn impair the antioxidant effect of serum albumin and blood circulating antioxidant. These changes occurred earlier and were more pronounced in the women whom preeclampsia later developed. Our results are also agreed with results obtained by (Fraile et al., 2003).<sup>[34]</sup> They observed that the Amide II/ Amide I ratio is higher for pure albumin as compared with Albumin-lipid systems. Their results revealed that lipids destabilize albumin native structure.

IR spectroscopy support at least modification of secondary structure in albumin upon addition of lipids [34]. The derivative gave the number and positions, as well as an estimation of the bandwidth and intensity of the bands making up the amide I region.

It should be mentioned here that although patients either with mild or severe preeclampsia are under medication but the IR second derivative spectra and protein secondary structure obtained from amide I components are also capable to differentiate all groups under investigations. The decrease in  $\alpha$ -helix structure of plasma protein might be responsible for the increase in  $\beta$ -turns structure in patient group.

During pregnancy, maternal lipids are elevated to supply the developing fetus with triglycerides and cholesterol<sup>[35]</sup> exaggerated lipid changes have been reported in women with preeclampsia. These differences have been documented both before and after clinical manifestations of preeclampsia.<sup>[35-38]</sup> Some investigators have suggested that dyslipidemia may contribute to the increased oxidative stress and endothelial dysfunction observed in preeclampsia.<sup>[36]</sup>

Plasma concentrations of very low density lipoprotein (VLDL) and LDL increase progressively with gestational age as reflected by increases in serum triglycerides and cholesterol.<sup>[39, 40]</sup> Gestational increases in estrogen are thought to promote hepatic production of VLDL triglyceride.<sup>[41]</sup> The patient group enrolled in this study were classified either with mild or severe preeclampsia (Table 1). Accordingly, the marked increase in the values of refractive index for the patient group at the band  $1475\text{ cm}^{-1}$  over the control 1 and 2 groups may be attributed to the significant higher triglycerides and higher total cholesterol to HDL ratio than controls. Since obesity, age, diabetes and kidney disease are all important risk factors for preeclampsia, we examined whether alteration in these parameters could account for the elevated refractive index (n) values. We have demonstrated that there is significant increase in (n) values in some patient and control-2 groups those with high BMI and/or young age. The blood group O<sup>+</sup> and A<sup>+</sup> might play a role in increasing the risk factor<sup>[18]</sup>, but this point should be studied in further details and with large sample number. It should be mentioned here that the increase in (n) value  $> 1.32$  for cholesterol can be considered as strong evidence and biomarker in diagnosis and early prediction of disease. On the other hand, the decrease in (n) values are not necessary prove of healthy pregnancy and normal cholesterol, TG and glucose level in plasma.

The present study has shown that the region of ester C=O stretch ( $1750\text{--}1700\text{ cm}^{-1}$ ) can be used as a marker for characterizing triglycerides (TG) and cholesterol, which are the main components for VLDL and LDL, respectively. The C=O stretching bands for unsaturated (TG) and unsaturated cholesterol exhibit a band at about  $1746$  and  $1738\text{ cm}^{-1}$ , respectively.<sup>[42]</sup> The peaks at  $1745$  (cholesterol and triglycerides ester C=O),  $1710$  (carbonyl C-O stretch), and  $1621\text{ cm}^{-1}$  (peptide C=O stretch) positively correlated with LDL oxidation.<sup>[43]</sup> According to the above mentioned data, the appearance of a very strong band at  $1741\text{ cm}^{-1}$  and a medium band at  $1710\text{ cm}^{-1}$  in patient plasma samples together the shoulder at  $1622\text{ cm}^{-1}$  or  $1626\text{ cm}^{-1}$ , in plasma samples IR second derivative and amide I component obtained from curve fitting respectively,

can be attributed to the oxidation of LDL during preeclampsia. (Morris et al., 1998)<sup>[44]</sup> found no evidence that circulating lipid peroxidation products (8-iso-PGF<sub>2</sub>, lipid hydroperoxides, and malondialdehyde) are elevated in preeclampsia once appropriate precautions were taken, including addition of antioxidants, to prevent in vitro oxidation. This finding disagreed with our results which showed that even preeclamptic women under medication their IR second derivative spectra gave the observed proatherogenic changes in lipid profile. Proatherogenic lipid profiles have been demonstrated in women months before clinical signs of preeclampsia.<sup>[45]</sup> Triglyceride levels are elevated, high density lipoprotein (HDL) levels tend to be lower, and small dense low-density lipoprotein (LDL) particles are higher in preeclampsia compared with normal pregnancies [35-38] this shift in LDL particle size to smaller and denser subfractions is thought to be particularly important, as these are highly susceptible to oxidation and may play a critical role in the endothelial dysfunction seen in preeclampsia.<sup>[28, 35]</sup> All of these proatherogenic changes in the lipid profile are also found in cardiovascular disease and diabetic subjects and represent those at high risk for coronary artery disease.<sup>[46]</sup>

Data from larger number of subjects throughout the pregnancy are needed for better assess the relevance of these markers to the diagnosis and early prediction of preeclampsia.

## 5. Conclusion

In summary, we have demonstrated a marked increase in cholesterol, TG and glucose in plasma begging 4- 8 weeks before the onset of preeclampsia, and accompanied by decreases in the protein intensity bands. This study together with our previous study on serum gives promising biophysical marker. The change in protein secondary structure, the changes in lipid profile together with the elevated refractive index for the 1475cm<sup>-1</sup> band could help in diagnosis and early prediction of preeclampsia. Thus, samples number 34 (one out of 31 normotensive control subjects) developed preeclampsia later, she was at 22 week of gestation. In addition, this study demonstrated that FTIR spectroscopy can be used in clinical analysis as a rapid and sensitive tool for studying human biofluids and biomolecules.

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## Gastrointestinal Trichobezoars, How They Present?

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**Abstract:** We report a case of gastrointestinal trichobezoar in a female patient, aged 7 years who, presented by chronic abdominal pain and diarrhea for a duration of 6 month. She had anorexia and low weight (16 kgm). Many investigations were done including stool analysis, urinalysis, and abdominal ultrasonography without any result. By accurate abdominal examination a very irregular epigastric mass was felt. An abdominal CT was performed that revealed (as reported by the radiologist): "multiple enlarged mesenteric lymph nodes and thickened mesentery which suggests tuberculous enteritis". Tuberculin test was negative. A therapeutic test for T.B. lead to no improvement. Abdominal exploration revealed a mass inside the stomach which was extracted by gastrotomy and proved to be a huge trichobezoar taking the shape of the stomach and extending from the fundus till the first part of the duodenum. [Khalid A. Sanousy and Mohammad A. Osman **Gastrointestinal Trichobezoars, How They Present?**. Journal of American Science 2011;7(4):837-839]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Keywords:** Bezoar, Trichobezoar,| Phytobezoar, Gastrointestinal bezoar,| Foreign bodies

### Introduction:

A bezoar is a conglomeration of partially digested or non-digested foreign material in the gastrointestinal (GI) tract, most commonly found in the stomach (1). There are various types of bezoars of which trichobezoar is one. Though most of the gastric bezoars occur as a complication of gastric or ulcer surgery, gastric bezoars may also be seen in the normal stomach as a result of ingestion of various objects which do not pass through the pylorus such as hair, paper and cotton.(2). Less commonly, bezoars are found in the small intestine and the colon and only a few in the rectum are reported in the literature (3). Bezoars may cause a wide variety of signs and symptoms depending on their location and can range from asymptomatic to occlusion and perforation (4). Bezoars are classified according to the materials which they are composed of (named in order of frequency): Phytobezoar made of vegetable fibers or plant material, trichobezoars are a result of ingestion of human hair, drug-bezoar contain accumulated masses of medication, lactobezoars made of undigested milk described in premature infants and in full term infants and other less frequent materials are named miscellaneous bezoars or polybezoars (5).

### 2. Case presentation

A female patient, 7 years old, presented by chronic abdominal pain and diarrhea for a duration of 6 month. She had normal mentality and no behavioral disorders could be elicited by history. She had anorexia and low weight (16 kgm). Many investigations were done including stool analysis, urinalysis, and abdominal ultrasonography without any result and many medications were given to the

patient with no improvement. By accurate abdominal examination an epigastric mass was felt. The mass was firm and so irregular as if it consisted of many small masses amalgamated together. An abdominal CT was performed that revealed (as reported by the radiologist): "multiple enlarged mesenteric lymph nodes and thickened mesentery which suggests tuberculous enteritis". A tuberculin test was performed to the patient with a negative result. Antituberculous treatment was started as a therapeutic test. After two weeks of antituberculous treatment, there was no improvement, moreover abdominal pain became worse and very severe inspite of giving antispasmodic injections and strong analgesics so, we consulted the pediatric surgery department asking for abdominal exploration. During the operation the surgeon discovered that the mass, felt by abdominal examination, is present inside the stomach so, a gastrotomy was done revealing a huge mass inside consisted of hair, rubber pieces, and leathery substances. The mass was huge taking the shape of the stomach and extending from the fundus of the stomach till the first part of the duodenum (figure 1).

The mass was extracted and a complete exploration of the small and large bowel was made to exclude presence of any other bezoars. After the operation there was complete improvement of the condition, and the patient started to gain weight. CBC, performed to the patient before the operation, revealed no anemia. The patient was subjected to psychotherapy, and the mother was instructed to observe her daughter thoroughly.



**Figure 1: The mass extracted from the stomach**

### Discussion

Bezoars are foreign bodies in the gastrointestinal tract that increase in size by accretion of non-absorbable food or fibre because of large particulate size, indigestibility, gastric outlet obstruction or intestinal stasis. The term “bezoar” is derived from Arabic “badzehr” or from Persian “panzehr”, both meaning counter poison and antidote (6). Trichobezoars are bezoars consisting of hair. They are seen most commonly in young people with normal gastrointestinal function and usually result from underlying behavioural disorders and mental retardation. In the classic review by DeBakey and Ochsner, 80% of trichobezoars were found in patients younger than 30 years of age (2).

Bezoars have been known to cause a wide variety of symptoms. In the stomach, they are associated with anorexia, bloating, early satiety, dyspepsia, malaise, weakness, weight loss, headaches, and a feeling of fullness or heaviness in the epigastrium (7). They may also present with gastrointestinal bleeding (6%) and intestinal obstruction or perforation (10%) (8). Plain X-rays are unique and lead to the diagnosis, however diagnostic difficulties arise in patients with radiolucent bezoars, and contrast studies of the GI tract by radiography and computed tomography (CT) scan are necessary in such circumstances. Upper GI endoscopy is the method of choice in detecting esophageal, gastric and duodenal foreign bodies. Occasionally, bezoars are found incidentally when an emergency laparotomy is done secondarily to bowel obstruction (4).

For small bezoars, endoscopy has been the treatment of choice (4). Most trichobezoars, however, require surgery for removal. The standard treatment is a gastrotomy and extraction of the bezoar (9). Frequently, synchronous bezoars are found in the stomach or other areas of the gastrointestinal tract; therefore it is mandatory to carry out a thorough exploration of the small intestine and colon to avoid recurrence of intestinal obstruction due to a retained bezoar (4). After discharge, recurrence has been reported in up to 14% of cases, especially in patients with psychiatric disturbances and with previous gastric surgery (10).

### Conclusion

Bezoars require a high index of suspicion for diagnosis and should be considered in the differential diagnosis of epigastric swellings in young patients especially those having mental retardation or behavioral disturbances. Trichobezoars are most commonly seen in patients with normal gastrointestinal tract function but with behavioural disturbances like trichophagia, trichotillomania and mental retardation. It is very difficult to explain the cause of trichobezoars in such patients without a known psychiatric history. Investigatory tools like; ultrasonography and CT are good and very informative but more important is the human being who interpret what is seen by these tools.

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## Field Studies on Effect of Probiotic on Reproductivity of 51 Weeks Old Broiler Breeder Chickens Fed on Mycotoxins Contaminated Ration

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**Abstract:** A total of 14100 Ross broiler breeders aged 51 weeks showing signs of mycotoxicosis were used in 9 weeks field study. The chickens were placed in 2 houses each contain 6600 female + 450 male. Birds of house 1 were treated with Senertox<sup>®</sup> (enzymes, organic acids and yeast extract) 0.5 ml/liter drinking water and house 2 was kept as nontreated. Reproductivity parameters were calculated for comparison of their effect. Treated flocks showed improved average egg production compared with nontreated, but all still lower than farm stander in the 1<sup>st</sup> 3 weeks (51-53) of treatment. Total 9 weeks production declined was 5.6% and 8.4% in Senertox and control flocks respectively. Control flock was slower in decline than treated flocks. Average cumulative egg production/ hen in treated flocks were lower than standard and nontreated. The Senertox show high weekly cumulative average egg production and hatched egg/hen (3.92 and 3.80) than nontreated control (3.83 and 3.73). Hatchery parameters of treated were improved in treated at the first 3 weeks post treatment; fertility and hatchability rates in Senertox (78.25% and 67.19%) were higher than those of nontreated (76.91% and 62.25); respectively. Culls % in hatched chicks was highest in nontreated flock (2.22%) than Senertox (1.91%). The difference between fertility - hatchability of treatment Senertox chickens was 10.84, while it was 9.72 in control. The drinking water treatment did not restore reproductively of treated flock to farm stander. In conclusion, our field study cleared that administration of antimycotoxins in drinking water as treatments of Ross broiler breeders resulted in a higher reproductive performance as compared with nonmediated control. So we still in need for more effective products to be used against mycotoxins in breeder chicken.

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**Key words:** Antimycotoxins, Nutritox, Synertox, Broiler breeder performance, reproductivity, Egg production, Fertility, Hatchability.

### 1. Introduction:

Aflatoxins are toxic metabolic product of *A. flavus*, *A. parasiticus*, and *Penicillium puberulum*, while Ochratoxin A (OA) is the most toxic product of *Penicillium viridicatum* and *Aspergillus ochraceus* (Dwivedi and Burns, 1986 and Aravind et al., 2003) causing disease conditions (Choudary and Rao, 1982; Jones, et al., 1982; Hetzel, et al., 1984; Dafalla, et al., 1987; Shoyinka, et al., 1987; Anjum, 1994 and Saif, et al 2003).

Nowadays, hundreds of mycotoxins are recognized (Uraguchi and Yamazaki, 1978). The synergistic interaction between OA and Aflatoxins was recorded by Huff, et al. 1975 and and1992). These mycotoxin contaminated feedstuffs when consumed, produce a range of severe devastating effects on the general well-being and productivity of farm animals and poultry (Devegowda et al., 1998). Mycotoxins affects poultry production by lowering weight gain (Asplin and Carnaghan, 1961), feed efficiency, egg production (Prior and Sisodia, 1978 and Bryden, et al., 1980) and reproductive performance, increased susceptibility to infectious

disease (Wyatt and Hamilton, 1975 and Bryden, et al., 1980) due to immune-suppression (Pier, 1973; Burns and Dwivedi. 1986 and El-Karim, et al., 1991), vaccine failure (Anjum, 1994; Azzam and Gabal, 1997 and 1998 and Bunaciu, et al., 1998) and interaction with mineral metabolism (Gardiner and Oldroyd, 1965), Low hatchability due to embryonic death in broiler breeders (Cottier, et al., 1969; Choudhury, et al., 1971; Niemiec, et al., 1995 and Zohair, et al., 2010) and impaired egg production (Kratzer, et al. 1969; Huff, et al., 1975 and Zohair, et al., 2010). Aflatoxin B1 (AFB1) is the most toxic and carcinogenic of aflatoxins (Wogan and Newberne, 1967). AFB1 has received considerable attention because it has revealed hepatotoxic potential in all single stomach animals studied to date (Moss, 1996). Probiotic is a live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance (Fuller, 1989). Probiotic preparations are being increasingly used in poultry diets to enhance growth rate, improve feed utilization and to control intestinal infections. Interestingly, some reports showed that probiotics can improve



appetite, egg size, egg weight (Nahashon *et al.*, 1992 and 1993) and egg production (Abdularahim *et al.*, 1996). In poultry production dietary acids (Hyden, 2000), live microfloral additives (Bedford, 2000) and mannanoligosaccharides (Demir *et al.*, 2001) in diets of chickens may help digestion by inhibiting bacteria growth and regulate pH value in intestines when incorporated into diet formulations.

There are many commercial products are used for detoxification including mycotoxin-binding agents holds promise for using contaminated feeds (Piva and Galvano, 1999). Esterified- glucomannan, a cell wall derivative of *Saccharomyces cerevisiae*, was protective against aflatoxin B1 and ochratoxin. *Lactobaccillus* cultures prevented absorption of aflatoxin from intestine (El-Nezami, *et al.*, 2000).

This study was carried out as a field trial to evaluate preventive value of detoxifying commercial product mixture including soluble enzymes, yeast extract and organic acids (Synertox) in Ross broiler breeders where reproductivity and hatchery parameters were determined during period 9 weeks of production to evaluate the total effect income of breeder flock.

## 2. Material and methods:

### Chicken:

A total of 14100 Ross broiler breeders 51 weeks old chickens including 13200 females and 900 males housed in 2 closed houses; approximately 6600 females with 450 males in each house.

### Ration:

Mash, corn, Soya, 16% protein broiler breeder layer ration manufactured according to Ross breeders management guide and adjusted to fulfill the requirements of layer breeder according to NRC (1984).

### Detection of Mycotoxins:-

The used ration was analyzed for detection of mycotoxins according to Soares and Rodriguez-Amaya (1989) and found to contain Aflatoxins (4 ppb) and Ochratoxin (2.45 ppb). The aflatoxin content of ration were analyzed by using immunoaffinity columns (Vicam AflaTest® Affinity Column) and quantified by high performance liquid chromatography (HPLC) (Agilent 1100 Series).

### Detoxifying products:

The following detoxifying commercial products were used according to producer's recommendations.

1. Nutritox (yeast extract and organic acids) 200 grams/ton of ration.
2. Senertox (enzymes, organic acids and yeast extract) 0.5 ml/liter drinking water. Medication was used for 3 successive days/ week and repeated for 3 successive weeks.

### Performance:

The calculated parameters in this field study were compared with control untreated house and farm stander for Ross breeder chickens for 9 weeks post medication between 51 and 59 weeks of age. Hen day production, hatching egg to evaluate effect of used drugs on productivity, while fertility, hatchability, difference between fertility and hatchability; culled chicks %, number of marketable chicks/1000 housed hens/day and weekly chicks / hen were calculated for reproductively.

### Diagnosis of Maycotoxycosis:

In relation to low reproductively and detection of toxins in ration Dead cases had hydropericardium and ascites. Liver was shrunk firm nodular or yellow fatty discolored, hemorrhages in the capsular surface, distended gallbladder, white foci also seen in hepatic tissues. Kidneys were pale with increased ureates and catarrhal enteritis (Saif, *et al.*, 2003).

### Experimental Design:

Both chickens and cockerels were fed same ration, houses 1 were fed Nutritox in ratio of 200 grams per ton of ration; houses 2 were given Senertox in ratio of 0.5 ml/liter drinking water for three successive days per week and repeated for three successive weeks, house 4 were kept as control nontreated. Results are shown in tables (1 and 2).

## 3. Results and Discussion:

Detoxifying agents and adsorbents are added to the manufactured poultry feed to prevent or minimize its toxic effect where we have no sufficient laboratory capability to confirm the purchase of ingredients free of mycotoxins. In addition, proper storage of ingredients, and feed processing, shipping and handling procedures are necessary to minimize mycotoxin formation (Dawson, 2001 and Saif *et al.*, 2003).

Weekly egg production rates were declined gradually as a physiological state, but this production was lower as compared to Ross Farm standard. Decline rates were slower in control flock than the treated flocks (Table 1).

The condition was diagnosed as a result of mycotoxycosis. As decrease in egg production was reported as signs of mycotoxycosis in breeder chickens (Choudhury, *et al.*, 1971; Prior and Sisodia, 1978; Page, *et al.*, 1980; Niemiec, *et al.*, 1995 and Zohair, *et al.*, 2010).

Treated flock showing improved average weekly egg production compared with nontreated, but all still lower from farm stander in the 1<sup>st</sup> 3 weeks (51-53) of treatment only. Production declined in 9 weeks was 8.40% and 5.5% in control and Senertox flocks; with average weekly decline 0.93 and 0.61; respectively.

On comparing average weekly egg production/hen housed Senertox the flock show highest average egg production (4.1 eggs/hen) at the 54th week and cumulative mean of 3.83 eggs/ hen (Table 1). This result explore that the used antitoxin increased egg production by detoxifying the mycotoxins in treated flock as reported by *Gazia et al (1991)* who found that acitic acid detoxifying ration contaminated aflatoxins.

Cumulative hatching egg per hen housed (Table 1) of treated with nontreated control and standard, the Senertox show the higher average cumulative egg production were (3.80 hatching egg / hen) with a cumulative hatching egg / hen of 3.9 - 3.8 for 5 weeks (52<sup>nd</sup> - 57<sup>th</sup>) and remain at 3.5 - 3.6 egg / hen for 2 weeks; than nontreated flocks as average cumulative hatching egg production were 3.73 egg / hen with irregular manner a trend 3.95, 3.55, 4, 3.8

remain at 4 eggs/ hen till the 56th week of age; followed by control treated flock where it was 3.95 - 3.85 eggs / hen in 52<sup>nd</sup> - 55<sup>th</sup> week with average 3.75 and 3.65 for 5 weeks in between 52<sup>nd</sup> and 57<sup>th</sup> weeks to reach 3.45 at 59<sup>th</sup> weeks. (Table1). The decrease in hatching egg/hen may be due to the effect of mycotoxins on egg quality as reported by *Page et al (1980)* who reported excessive number of egg shell stains and decreased egg production and *Niemiec et al (1995)* found that Ocratoxin A 2.1 and 4.1 ppm in chicken feed affect egg quality (thickness and crushing strength). This effect was explained by *Prior et al (1981)* reduced egg production in hens may be due to interference with synthesis, transport or deposition of egg constituents as proteins or by change in ovulation times.

**Table (1): Average weekly egg production rate, egg/hen production and hatching egg/hen of farm stander treated and control flocks.**

Age/weeks	Weekly egg production			Weekly/Egg/hen production			Weekly hatching egg/hen		
	Stander	Senertox.	Control.	Stander	Senertox.	Control.	Stander	Senertox.	Control.
51	80.0	63.5	66.5	5.95	4.00	4.10	4.90	3.90	4.00
52	79.0	63.2	64.9	4.90	4.00	4.00	4.64	3.90	3.95
53	78.0	63.4	64.0	4.90	4.00	3.90	4.66	3.90	3.55
54	77.0	63.6	63.5	4.80	4.10	3.85	4.50	3.80	4.00
55	76.0	63.7	62.5	4.70	4.00	3.85	4.40	3.90	3.8
56	75.0	61.7	61.2	4.70	4.00	3.90	4.40	3.90	3.75
57	75.0	59.0	60.1	4.60	3.80	3.75	4.40	3.80	3.65
58	74.0	59.1	59.2	4.60	3.70	3.60	4.30	3.50	3.45
59	74.0	58.0	58.1	4.60	3.70	3.55	4.30	3.60	3.45
CAWEP*	76.4	61.7	66.5	4.86	3.92	3.83	4.50	3.80	3.73
Difference**	6.0	5.5	8.4	0.99	0.08	0.27	0.40	0.10	0.27

\* CAWP: Cumulative average weekly production.

\*\* Difference: production of week 51- production of week 59.

Hatchery parameters in table (2) including fertility, hatchability and culled chicks of treated with control flock at the first 3 weeks post treatment as average rates; the highest fertility were in Senertox (78.25%) then nontreated control (76.91%). On comparing difference between fertility and hatchability of treatment chickens the highest was in Senertox treated (10.84) and nontreated control were (9.72). The hatchability was in Senertox flock (67.91%) and it was 67, 19% in nontreated control. The

reducing effect of mycotoxins on fertility and hatchability of breeder chickens was also reported by *Cottier, et al. (1969)*, *Choudhury, et al. (1971)*, *Niemiec, et al.(1995)* and *Zohair, et al., (2010)*. While *Prior and Sisodia (1978)* found no significant difference in hatchability in white leghorn aged 26-32 weeks feed Ocratoxin A in concentration of 1-4 ppm. The reduced hatchability was attributed to Ocratoxin that affect egg shell quality lead to greater loss of egg weight during incubation and lowered hatchability

(Niemiec *et al.*, 1995). Additionally, Cottier, *et al.* (1969) and Howarth and Wyatt (1976) reported that loss of hatchability due to embryonic death was the most sensitive indicator of aflatoxicosis in broiler breeders and also for Ochratoxin (Gilani, *et al.*, 1975). So, the improved results in the treated flock can be attributed to the used antimycotoxin as reported by

Murthy and Devegowda (2004) who demonstrated that modified glucomannan (a cell wall derivative of yeast) had the ability to adsorb more than 75 % of the aflatoxin within 30 minutes after feeding the aflatoxin-contaminated diet.

**Table (2) Fertility, hatchability and difference in-between, culls, marketable chicks/1000 in treated and control breeder chickens.**

Treatment	Fertility %	hatchability %	Fert. – Hatch%	Culls %	Marketable Ch./1000	Chicks/hen/week
Farm stander	84.50	75.33	9.17	0.53	572.70	4.00
Senertox	78.25	67.91	10.84	1.91	411.55	2.88
Control.	76.91	67.19	9.72	2.22	410.16	2.87

Percentages of culls in hatched chicks were the lowest in Senertox flock (1.91%), than nontreated (2.22%). The increased cull percentage can be attributed to the teratogenic effect of Ochratoxin A on chicken embryos (Gilani, *et al.*, 1975). Number of marketable chicks/1000 hen/day in Senertox and nontreated was 411.55 and 410.16; accordingly; marketable chick/hen/week was 2.88 and 2.87 in Senertox and control; respectively.

In conclusion, our field study pointed out that the administration of antimycotoxins in water as treatments of Ross broiler breeders resulted in a lower performance data as compared with nonmediated control; consequently our results indicated that we still in need of more save products for mycotoxins in breeder chicken flocks.

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## Pulsed Electromagnetic field versus Microcurrent on Treatment of Mechanical Low Back Pain in Post Menopausal Women

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**Abstract:** Background: Mechanical low back pain is considered as a serious health problem worldwide especially in post menopausal period because it certainly can limit function and capacity in both work and personal life. Purpose of the study: to investigate and compare the efficacy of pulsed electromagnetic field versus microcurrent in treatment of mechanical low back pain in post menopausal women. Methodology: Thirty post menopausal women complaining from mechanical low back pain participated in this study. Their age ranged from 50 to 60 years. They were divided randomly into two groups of equal number. Group A received the pulsed electromagnetic field therapy while group B received microcurrent therapy on lower back region. Both groups received the same physical therapy program which includes infrared, stretching exercises and strengthening exercises for back and abdominal muscles for four weeks. Pain severity and lumbar range of motion (flexion, extension, right rotation and left rotation) were measured respectively by serum cortisol level and Back range of motion device (BROM) before and after four successive weeks of treatment. Results: indicated that there was statistically significant improvement in back pain and lumbar range of motion in group "A" compared with those in group "B". Conclusion: Pulsed electromagnetic field proved to be more beneficial than microcurrent in improving lumbar range of motion and perceived back pain in post menopausal women with mechanical low back pain.

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**Key words:** Pulsed electromagnetic field, Microcurrent, Mechanical Low Back Pain, Post menopausal period

### 1. Introduction:

Low back pain (LBP) has been, and continues to be, one of modern human beings most common and complex ailments. It has been estimated that almost eight out every ten people will experiencing back pain in their life<sup>13</sup>. LBP is increasingly recognized as a complex syndrome with multifactor etiology. Its pathogenic mechanism leads to the development of chronic pain<sup>14</sup>. The incidence of LBP ranges between 60% and 90% of individuals sometime in their life and is the leading cause of disability<sup>4</sup>. Mechanical low back pain (MLBP) represents great variety of conditions that causes inappropriate back function. It is considered one of the most frequently treated and most costly in modern industrial societies<sup>26</sup>. MLBP is defined as pain in lower lumbar region without neurological deficit due to postural or occupational stress lead to irritation of pain sensitive tissue. Those patients characterized by reducing spinal mobility and painful functional activity<sup>5</sup>. It is often chronic, dull, aching pain of varying intensity that affect the lower spine might spread to the buttocks. Pain is increased during activity such bending, twisting, lifting, prolonged standing and sitting<sup>22,11</sup>.

In the post menopausal years, all women experience the physical effects of aging and may also be affected by the hormonal changes responsible for menopause. These changes can include serious health conditions. Determining risk factors for these diseases as early as possible allows women to employ preventive strategies. Menopause presents an opportunity for a woman to undergo a personal risk evaluation, whether it's for the first time or a reassessment<sup>23</sup>. The relationships between the factors influencing LBP in post menopausal women such as menopausal symptoms, bone mineral density, duration of menopause, hormonal therapy, obesity, inactivity, parity, and osteoarthritis had been studied in 134 post menopausal women. It was proved that women with back pain reported more severe menopausal symptoms than those without back pain and a recognized association was found between the prevalence of LBP in post menopausal women, menopausal symptoms and health habits<sup>1</sup>. Pregnancy as well as oral contraceptive use before menopause and the use of estrogens during menopause resulted in higher estrogen levels that increased laxity of joints and ligaments so, chronic LBP may occur<sup>5</sup>.

As a result of wide spread and increases of LBP, it has created the opportunity for developing



variety of approaches to deal with it. There were many trials have been carried out with some success, including the use of active exercise, Trance Electrical nerve stimulation, traction, bed rest, drug therapy, corset and others for managing LBP<sup>12</sup>. Pulsed electromagnetic field is a physical therapy modality which has been used widely in the management of nerve paralysis, migraine, carpal tunnel syndrome, LBP, ulcers, bed sores, itching skin disease, chronic osteomyelitis, retarded healing, osteoporosis, frozen shoulder, aseptic necrosis, tennis elbow, calcaneal spur, arthritis, tinnitus, sinusitis, trigeminal pain and other conditions<sup>25,19</sup>. Electrical stimulation is based on the fact that human body has an endogenous bioelectric system that enhances healing and relieving pain. When the body's endogenous bioelectrical system fails, cannot contribute to either the healing process or pain relieving. External current may serve to mimic the failed natural bioelectric currents, so that pain relieving or processes can be preceded. Microcurrent electrical neuromuscular stimulation (MENS) is better in enhancing cellular physiology processes than other current of higher amplitude, microcurrent is effective in the noxious and inflammatory disorders<sup>24</sup>. Microcurrent therapy uses extremely small amounts of electrical current to help in relieving pain and healing of the soft tissues injuries<sup>9</sup>.

This study was performed to investigate and compare the effect of pulsed electromagnetic field versus microcurrent stimulation on reducing mechanical low back pain (MLBP) and improving lumbar range of motion in post menopausal women.

## 2. Materials, Methods and Subjects:

Thirty post menopausal women complaining of MLBP for more than 3 months were diagnosed by an orthopedist and referred from orthopedic out – clinics of Cairo University Hospitals to participate in this study. Their ages ranged from 50 to 60 years. They were assigned randomly into 2 groups in equal number. Group (A) received the pulsed electromagnetic field therapy while group (B) received microcurrent therapy. Both groups received same physical therapy program which include infrared, stretching exercises and strengthening exercises for back and abdominal muscles for four weeks. BMI of all subjects were  $<30 \text{ Kg/m}^2$ .

### Exclusion Criteria:

All participated women did not have low bone mineral density or pathologic disorders at spine, hip, knee or ankle as well as previous surgery at the lumbar vertebrae and genital prolapse. They were housewives and did not smoke. They did not receive

any type of hormonal replacement therapy and or pain killer drugs throughout the study.

### Instrumentation:

#### A) Evaluation

##### 1-Weight-height scale

It was used for measuring weight & height of each patient for BMI calculation to exclude obese patient  $>30 \text{ Kg/m}^2$ .

##### 2- Elexcess twenty ten device:

It manufactured by Roch Company - Germany and used to analyze a venous blood sample to estimate the serum cortisol level (SCL).

##### 3- Back Range of Motion Device(BROM):

It was used for measuring trunk motion (flexion, extension, lateral flexion and rotation). It uses a unique combination of inclinometer and goniometer technology with a standardized protocol to easily provide objective repeatable measurement. It is a valid and reliable instrument for measuring lumbar range of motion<sup>16</sup>.

#### B) Therapeutic

##### 1-Pulsed electromagnetic field therapy ( PEMF)

The pulsed electromagnetic unit ASA magnetic field (Automatic PMT Quattro pro) and its serial number is (00001543) .It consists of an appliance, motorized bed and solenoids. The appliance was connected to electrical mains supplying 230V at a frequency of 50 or 60 Hz with earth connection. It generated pulsed magnetic field up to 100 Hz and intensity varied according to the type of solenoid. It was used in the treatment of patient in group "A".

##### 2- Microcurrent electrical neuromuscular stimulation (MENS) device:

Zimmer Elektromedizin is a device of electrical stimulation. It consists of three devices, Galva 5, Sono 5 and Vaco 5. Microcurrent electrical stimulation is program number 17 in Galva 5 device. It made in GermanyIt is a device of electrical stimulation. It was equipped with two self electrodes; each electrode was about 8 Cm in diameter. . It was used in the treatment of patients in group B.

##### 3-Infrared unit:

Its model is 4004/2N. The device has a power of 400w, voltage 203v and frequency of 50/60Hz. It was used as a form of heat prior to stretching, mobilization, traction, massage and exercise therapy.

### Procedures

#### A) Evaluation

Each patient of both groups was asked to fill out the information sheet and signed a written consent form before starting. Then she was informed about assessment & treatment. Patients were instructed to report any side effects during the treatment sessions.

- Pain assessment:

Pain assessment was done by measuring the serum cortisol level via elxcess twenty ten device. A venous blood sample of 8C.C was taken in the morning at 9 am, centrifuged and stored at 20°C till analyzed. Serum cortisol level was measured before as well as after one month of treatment.

- BROM assessment:

It was done by BROM device where the subject was instructed to stand straight with feet apart. The hands were hanged loosely at the subject's sides. The examiner stood beside the subject and adjusted the Velcro straps on the base so three fingers can be inserted and the thumb placed under the wing then traced the outline of the subject's feet on a piece of paper attached to the ground so subsequent measurement could be taken in the same position. S1 was palpated by the examiner and marked with adhesive dots by standing behind the subject and placed his fingers on the top of the iliac crests and the thumb on the midline of the back at L4-L5 junction. L4 and L5 spinous process are reference point from which can identify other vertebrae, then the examiner palpated inferiorly for the spinous process of S1 to locate and mark T12. Then measurement of trunk flexion, extension, side bending, external and internal rotation were performed by taking the pointer reading.

## B) Therapeutic

All patients in the both groups were received the same physical therapy routine that consisted of:  
1- Superficial heating (infrared lamp) for 20 min./session at distance of 60 cm from lumbar region, while patients in prone lying position for 12 session /week.

2- Exercise program that consisted of:

- Self – stretching exercise for the lumbar erector spinae muscles and tissues posterior to the spine.
- Mild stretching exercises for 30 seconds for hamstring, calf muscles, and back muscles from long setting
- Strengthening exercises for back muscles as bridging and active back extension.
- Abdominal muscles as sit up exercise and posterior pelvic tilt

Each exercise was performed five times/session, with hold for 5 counts with one minute rest between each

exercise, it was done 3 days/week, day after day for one month.

### 3- PEMF for group A

PEMF was applied once daily, 3 times /week for 4 weeks. Each session was conducted for 20 minutes over the lower lumbar region with the patient was placed in a comfortable prone lying position. Pulsed electromagnetic field frequency was 10 Hz, intensity of 20 gauss and duration of 20 min.

### 4- MENS for group B

MENS was applied once daily, 3 times /week for 4 weeks. Each session was conducted for 20 minutes over the lower lumbar region with the patient was placed in a comfortable prone lying position. The electrodes were soaked with normal saline and placed over the lower lumbar region paravertebrally with 5 Cm in between and adhesive plaster was used for fixing the electrodes.

### Statistical Analysis:

Data were collected and analyzed using mean, standard deviation and unpaired t-test. All statistically significant differences were determined with a confidence interval of 95% and thus at  $p < 0.05$ .

## 3. Results

In this study MLBP was recorded by serum cortisol level and back range of motions for each subject in both groups A&B before and after 4 weeks of treatment.

In concerning Serum Cortical Level, There was statistically non significant difference in pre treatment values between both groups ( $P < 0.71$ ). While there was a statistically highly significant difference after treatment ( $P < 0.004$ ). This indicates significant reduction in pain level in group A than group B.

Table (1): Serum cortisol level pre and post treatment for both groups A and B.

### In concerning Lumbar range of motion:

#### Lumbar Flexion& extension:

There was statistically non significant difference ( $P > 0.05$ ) in pre treatment values between group A& B in Lumbar flexion & extension movements. While in the post treatment values, there was a statistically highly significant difference ( $P < 0.01$ ) for Lumbar flexion and lumbar extension ( $P < 0.0001$ ) also.

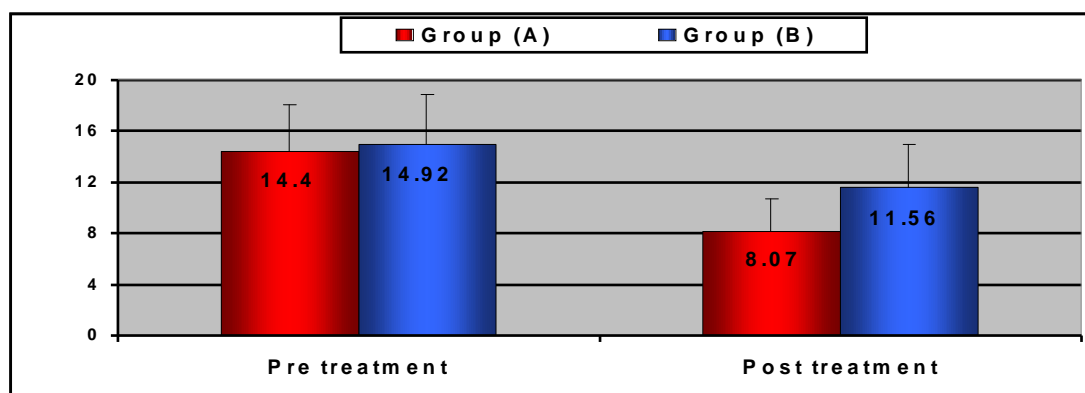


Figure (1): Values of serum cortisol level pre and post treatment of both groups (A, B).

Table (1): Serum cortisol level pre and post treatment for both groups A and B

	Lumbar Flexion			
	Pre treatment		Post treatment	
Groups	Group (A)	Group (B)	Group (A)	Group (B)
Mean $\pm$ SD	26.4 $\pm$ 3.54	27.13 $\pm$ 3.09	35.06 $\pm$ 3.71	31.53 $\pm$ 3.46
Mean difference	0.73		3.53	
t-value	0.6		2.69	
P-value	0.55		0.01	
S	NS		HS	

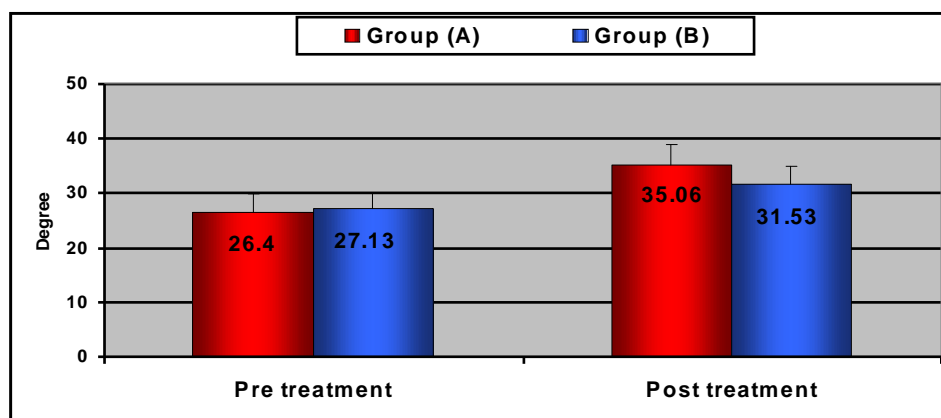


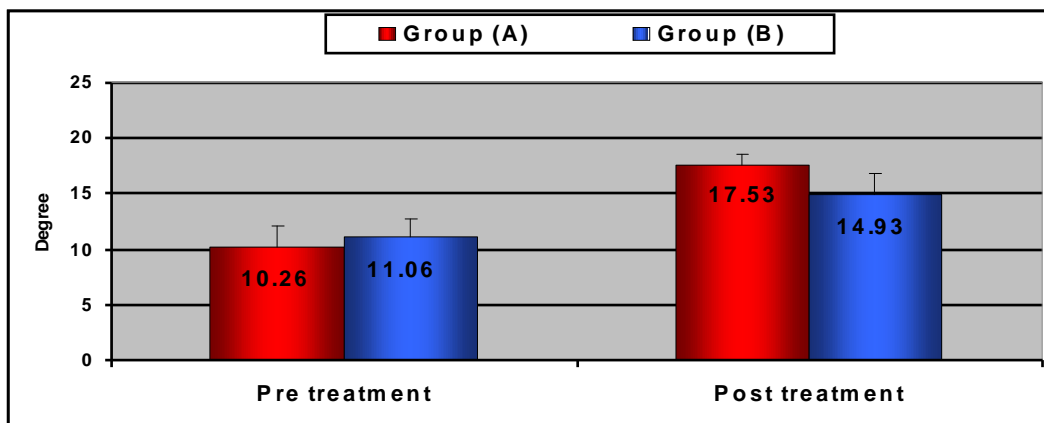
Figure (2): Mean and  $\pm$ SD of lumbar flexion pre and post treatment of both groups (A & B).

Table (2): lumbar flexion pre and post treatment of both groups A & B

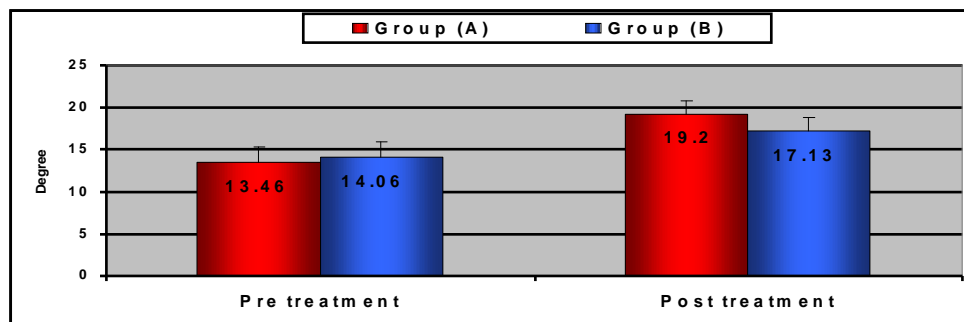
	Serum Cortical Level			
	Pre treatment		Post treatment	
Groups	Group (A)	Group (B)	Group (A)	Group (B)
Mean $\pm$ SD	14.4 $\pm$ 3.63	14.92 $\pm$ 3.94	8.07 $\pm$ 2.6	11.56 $\pm$ 3.46
Mean difference	0.51		3.49	
t-value	0.37		3.11	
P-value	0.71		0.004	
S	NS		HS	

**Table (3): ): lumbar extension pre and post treatment of both groups A & B**

	Lumbar Extension			
	Pre treatment		Post treatment	
Groups	Group (A)	Group (B)	Group (A)	Group (B)
Mean $\pm$ SD	10.26 $\pm$ 1.86	11.06 $\pm$ 1.66	17.53 $\pm$ 1.06	14.93 $\pm$ 1.98
Mean difference	0.8		2.6	
t-value	1.23		4.48	
P-value	0.22		0.0001	
S	NS		HS	

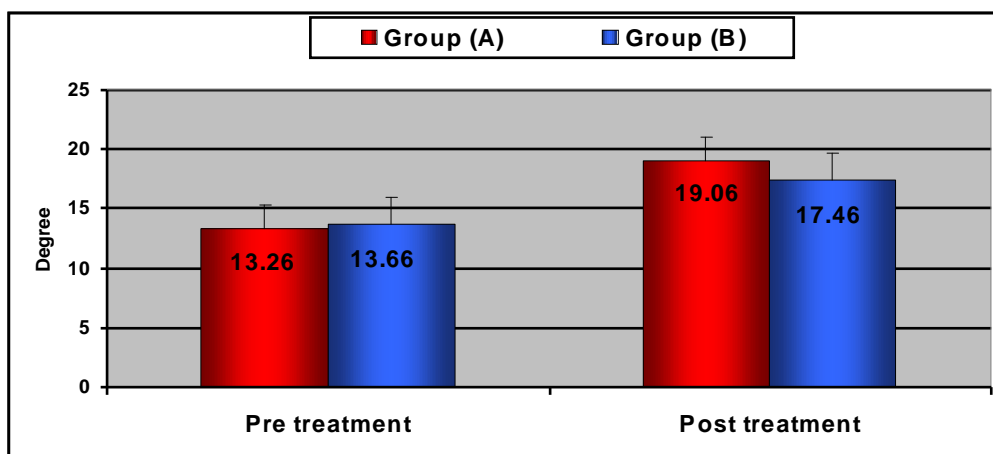
**Figure (3): Mean and  $\pm$ SD of lumbar extension pre and post treatment of groups (A & B).****Table (4): lumbar right rotation pre and post treatment of both groups A & B**

	Lumbar right rotation			
	Pre treatment		Post treatment	
Groups	Group (A)	Group (B)	Group (A)	Group (B)
Mean $\pm$ SD	13.46 $\pm$ 1.99	14.06 $\pm$ 1.9	19.2 $\pm$ 1.61	17.13 $\pm$ 1.72
Mean difference	0.6		2.06	
t-value	0.84		3.38	
P-value	0.4		0.002	
S	NS		HS	

**Figure (4): Mean and  $\pm$ SD of lumbar right rotation pre and post treatment of both groups (A& B).**

**Table (5): lumbar left rotation pre and post treatment of both groups A & B**

	Lumbar left rotation			
	Pre treatment		Post treatment	
Groups	Group (A)	Group (B)	Group (A)	Group (B)
Mean $\pm$ SD	13.26 $\pm$ 2.05	13.66 $\pm$ 2.35	19.06 $\pm$ 1.9	17.46 $\pm$ 2.23
Mean difference	0.4		1.6	
t-value	0.49		2.11	
P-value	0.62		0.04	
S	NS		HS	

**Figure (5): Mean and  $\pm$ SD of lumbar left rotation pre and post treatment of both groups (A & B).****Lumbar rotation:**

There was non statistically significant difference in pre treatment values between both groups A & B in lumbar right & left rotation. While, in the post treatment values there was a statistically highly significant difference ( $P < 0.002$ ) & ( $P < 0.04$ ) for right & left rotation respectively.

**4. Discussion:**

MLBP is one of the most common causes of inappropriate back function. Magnetic therapy and microcurrent have been reported to be effective in the treatment of patients with back pain. Our study was conducted to compare the effects of PEMF with frequency of 10Hz, intensity of 20 Gauss and duration for 20 minutes per session, 3 sessions per week for successive 4 weeks versus microcurrent for 20 minutes per session, three sessions per week for successive 4 weeks on improvement of back pain, and back range of motion in MLBP in post menopausal patients.

Thirty post menopausal female suffered from mechanical low back pain, were assigned randomly into two treatment groups. Group A received MLBP in addition to physical therapy program (infrared radiation, stretching exercise for

back and hamstring muscles and strengthening exercise for back and abdominal muscles). Whereas females in the group B were treated by micro-current therapy in addition to the same physical therapy program that given to group A. The results of the current study showed statistically significant improvement in pain levels and lumbar ROM in the group A more than group B at the end of 4 weeks treatment.

Pain and lumbar range of motion were assessed before and after treatment both groups. All patients in both groups had symptoms of low back pain. This agrees with Morki and Sinaki who reported that low back pain generally is marked by pain increasing during activity such as bending, twisting, lifting, prolonged sitting and standing. They also had decrease of functional ability and back range of motion due to pain and muscle spasm<sup>22,8,17</sup>

The improvement of pain level was better in group A that treated by PEMF than group B that treated by microcurrent at the end of treatment. This result come in agreement with others who postulated that magnetic therapy has become one of the most rapidly emerging alternative therapies where magnets have been promoted for their analgesic and energizing effects with no side effects unlike



drugs<sup>20,29</sup>. The analgesic effect of pulsed electromagnetic field therapy could be attributed to the physiologic mechanisms of pain relief which may be due to presynaptic inhibition or decreased excitability of pain fibers<sup>6</sup>. Other postulation is magnetic field influences the small C-fibers and produces a reversible blockade of sodium-dependent action potential firing and calcium dependent response to the irritant<sup>30</sup>. Shupak et al., 2004 found that the analgesic effect of PEMF could be attributed to the neuropathic pain arising from firing of unmyelinated C fibers with accumulation of sodium and calcium channels because PEMF safely induce extremely low frequency current that can depolarize, repolarize neurons. It was hypothesized that this energy could potentially modulate neuropathic pain. Pulsed electromagnetic field can modulate the actions of hormones, antibodies and neurotransmitters surface receptor sites of a variety of cell types. This may cause changes in the transfer rate of electrons during the electron exchange between single molecules that may either slow down or accelerate chemical reaction<sup>27</sup>.

Other explanation for pain improvement is that PEMF causes the membrane to be lowered to a hyper-polarization level of about (-90 mV) so it blocks the pain signal transmission. Magnetic field also influence ATP production; increases the supply of oxygen and nutrients via the vascular system; improves the removal of waste metabolites via the lymphatic system and help to rebalance the distribution of ions across the cell membrane thus reducing pain; reducing muscle spasm.<sup>15</sup> In addition to analgesic effect, the PEMF has positive anti-inflammatory which leads to decrease pain and improve back function<sup>18</sup>.

Regarding to the group B there was significant reduction of pain level after treatment but less than group A. This come in agreement with McMakin et al., 2005 who reported that the efficacy of microcurrent for reduction in pain improvement scores with accompanying substantial reduction in serum levels of the inflammatory cytokines IL-1 (which can increase the number of bone marrow cell), IL-6 which is a pro-inflammatory cytokine secreted to stimulate immune response to trauma especially in tissue damage. It is elevated in response to muscle contraction, and TNF-X and neuropeptide substance P. Beta-endorphin release and decreases in serum cortisol and increase Serotonin which is a neurotransmitter that helps you feel good. Others reported a favorable effect of MENS on pain control through the modification and recruitment of cell membrane ATP, this occurred mostly under conditions of chronic pain<sup>21</sup>. These results are contradicted with the work of Jennifer who found that

the biochemical increases in collagen formation after MENS are advantageous but may not be reflected when clinical measures such as ROM and pain measures are used. They also found that microcurrent stimulation was not effective in reducing pain and loss of ROM associated with muscle soreness<sup>10</sup>.

The results of lumbar ROM obtained in the current study showed that there was significant increase of lumbar flexion, extension, right and left rotation after treatment for the two groups but the improvement of group (A) was more than group (B). PEMF appeared to be effective in improvement of lumbar ROM. This occurred because the spine mobility was affected in MLBP patients as a result of pain avoidance behavior which caused the muscles and ligaments not to be used to their ultimate limits or full ROM. If the limited lumbar ROM was maintained for a long period of time, the ROM would actually decrease as the soft tissues shorten and strength decreases especially lumbar flexion as a result of shortening of the back and hamstring muscles<sup>2</sup>. The improvement in trunk range of motion in MLBP patients in this study could be attributed to the positive analgesic effect, anti inflammatory effect and reduction at muscle spasm so improve lumbar mobility and range of motion<sup>28</sup>. These results were supported by Van Nguen and Marks 2002 who found that PEMF decreases joint and muscle pain, decreases joint swelling and stiffness and improve soft tissue repair so increase mobility and quality of life<sup>29</sup>. Also, the application of magnetic field to the musculoskeletal problem can reduce pain, inflammation and enhance movement<sup>6</sup>.

Regarding the patients in group B who received MENS, there was improvement in the lumbar ROM but less than that of the group A who received PEMF; this may be due to that MENS can mainly decrease the pain level which will improve the mobility which may be in a short term. This was supported by McMakin et al., 2005 who reported that MENS has been shown to be effective in the treatment of myofascial LBP as it reduced pain and increased range of motion<sup>21</sup>. These results are contradicted with Denegar who found that MENS provided transient analgesia but did not significantly reduce the loss of strength associated with muscle soreness.

The data obtained in this study revealed that both PEMF and MENS were effective modalities for treating MLBP as there were significant differences in pain level, lumbar ROM after treatment but PEMF was more effective than MENS in treating MLBP in post menopausal women. The significant difference between the PEMF group and MENS group might be related to the different mechanisms of action and the different effects of the PEMF on the living cells and tissues which included vasodilatation, analgesic action, anti-inflammatory action, healing acceleration

and anti-oedematous activity. This also might be due to the biological effects of the magnetic field on biological systems included several structural levels; subatomic, atomic, molecular, subcellular, cellular, tissue, organs and whole system.

In conclusion, it could be recommended that application of PEMF was effective as a treating method for MLBP in post menopausal women owing to its analgesic and anti-inflammatory effects so it helps in reducing pain and functional disability and improving lumbar range of motion.

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**Detection of hepatitis C virus RNA in the saliva using real-time PCR with emphasis on oral lichen planus**El-Zarka M. S,<sup>1</sup> El-Nouaem M. I. <sup>1</sup>, Metwally D E. <sup>2</sup> and Essawy M. M.<sup>1</sup><sup>1</sup> Oral Pathology Department, Faculty of Dentistry, University of Alexandria.<sup>2</sup> Microbiology Department, Medical Research Institute University of Alexandria.[dr.dalia.ragab@hotmail.com](mailto:dr.dalia.ragab@hotmail.com).

**Abstract:** HCV plays an important role not only in liver diseases but also in the establishment of extrahepatic manifestations and immune abnormalities. Oral lichen planus (OLP) that appears in the oral cavity has been reported as an extrahepatic lesion induced by HCV. HCV RNA has been detected in the saliva of HCV positive patients. If sterilization and disinfection techniques are inadequate, there is an increased risk of HCV transmission to exposed individuals. The current study included a group of 40 HCV RNA positive patients. Paired blood and saliva samples were tested by real time PCR for HCV viral. Dental examination was performed for all patients. HCV RNA was found in 17 out of the 40 saliva specimens (42.5 %), obtained from the patients. No statistical significant relation was found between the detection of HCV RNA in the saliva and the different dental treatments as risk factors. There was no correlation between viral load in the serum and viral load in saliva. Also, there was no statistically significant relationship between serum HCV RNA viral load and the detectability of HCV RNA in the saliva. Three patients out of 40 (7.5%) had OLP.

[El-Zarka M. S, El-Nouaem M. I. , Metwally D E. and Essawy M. M. **Detection of hepatitis C virus RNA in the saliva using real-time PCR with emphasis on oral lichen planus**. Journal of American Science 2011;7(4):854-859]. (ISSN: 1545-1003). <http://www.americanscience.org>.

**Keywords:** HCV; saliva; oral lichen planus; real time PCR.

**1. Introduction**

Hepatitis C virus (HCV) is estimated to have infected 170 million people worldwide <sup>(1)</sup>. The published prevalence rates of HCV infection vary considerably in different countries and even in different parts of one country. Prevalence ranges from as low as 0.3% in Sweden to more than 14% in Egypt. Approximately one-quarter of patients with chronic HCV hepatitis will ultimately develop cirrhosis and a significant proportion will go on to hepatocellular carcinoma (HCC) <sup>(2)</sup>.

HCV also plays an important role not only in liver diseases but also in the establishment of extrahepatic manifestations and immune abnormalities <sup>(3)</sup>. A wide variety of extrahepatic disease manifestations have been reported to be associated with HCV infection <sup>(4)</sup>. Infection with HCV has been implicated in sialadenitis with sicca syndrome. The presence of HCV virus in saliva samples may be an indirect evidence of salivary gland involvement. Geographic variations, changes in the predominant genotypes, and their association with environmental factors, may affect extrahepatic manifestations of HCV infection, such as sialadenitis <sup>(5)</sup>.

Oral lichen planus (OLP) that appears in the oral cavity has been reported as an extrahepatic lesion induced by HCV <sup>(3)</sup>. Numerous cases of lichen planus in patients with hepatitis C virus (HCV) infection have been published and an association of

chronic hepatitis with lichen planus has been established. However, an association between HCV infection and lichen planus is uncertain because the prevalence of HCV infection in patients with lichen planus varies considerably from one geographic area to another, ranging from 4% in northern France to 62% in Japan <sup>(6)</sup>.

In developing and transitional economy countries, nosocomial transmission of HCV through the re-use of contaminated or inadequately sterilized instruments used in medical, paramedical and dental procedures remains a major source of HCV infection and puts the public in these areas at high-risk <sup>(2)</sup>.

In the most rigorous epidemiological studies on HCV, the prevalence of patients in whom it is not possible to identify any risk factor for acquiring the infection ranges from 10% to 14% <sup>(7)</sup>. Therefore, in order to assess non-parenteral routes of transmission, the detection of HCV in body fluids other than blood is of great importance. Sero-epidemiological surveys indicate that saliva may be a potential source of infection <sup>(1)</sup>.

The detection of HCV in saliva can be made indirectly by measuring antibody levels or by amplification of viral RNA. The efficacy of the detection of HCV antibodies in saliva by ELISA has been evaluated in several studies and has good sensitivity of 84.1 – 98.2 % and specificity of 99.1 – 100 % <sup>(8- 12)</sup>. Suggesting that ELISA methods for detection of HCV antibodies in saliva can be used in

epidemiological surveys <sup>(12 - 14)</sup>. Despite these high values, the low concentration of antibodies in saliva may result in false negative results <sup>(9,15)</sup>. Also, immunocompromised patients fail to generate an immune response to HCV, which result in false negative results <sup>(9)</sup>. On the other hand, assays for testing salivary anti-HCV are not available commercially at present <sup>(12)</sup>.

HCV RNA has been detected in the saliva of HCV positive patients. Significant variability in HCV-RNA detection frequency in saliva samples was found in a careful review of the HCV literature from 1990 to 2003. Published data indicated a frequency of HCV RNA in saliva samples from 0 to 100% <sup>(5)</sup>.

Studies have indicated that there is extensive HCV contamination of dental surgeries after treatment of anti-HCV positive patients. If sterilization and disinfection techniques are inadequate, there is an increased risk of HCV transmission to exposed individuals <sup>(1)</sup>.

The aim of this study was to determine HCV RNA viral load in saliva from HCV RNA positive patients and correlate it to the serum viral load. The correlation between presence of HCV RNA and oral pathology was also studied.

## 2. Materials and methods

### Study Population

The current study included a group of 40 HCV RNA positive patients; 18 males (45%) and 22 females (55 %) with a mean age of  $45.95 \pm 8.9$  years (range 28 – 70 years), attending the outpatient clinics in the Medical Research Institute, and the Maxillofacial Surgery Department, Faculty of Dentistry, Alexandria University over a period of 6 months; from September 2009 to February 2010.

The following information was recorded: age, gender, residence, occupation, history of blood transfusion, surgical operations, family history of HCV, bilharziasis and its treatment, and dental care status. Dental examination was performed for all patients.

### Specimen Collection

Paired blood and saliva samples were obtained from each participant. The blood was collected in sterile tubes, and the serum was separated by centrifugation. Non-stimulated saliva samples were collected by spitting into a sterile falcon tube. Saliva was recovered by centrifugation and visually checked for the presence of blood cells.

Both saliva and serum were stored at  $-20^{\circ}\text{C}$  until tested by real time PCR.

Tissue biopsy was taken from suspected lesions and examined histopathologically by H&E stain.

## Detection, and Viral Load of HCV in Serum and Saliva

RNA extraction. Total RNA was extracted from 140  $\mu\text{l}$  of serum and 560  $\mu\text{l}$  of saliva specimens using a QIAamp viral RNA kit (QIAGEN, Valencia, CA) following manufacturer's instructions.

Ten  $\mu\text{l}$  of extracted RNA was amplified by using 12.5  $\mu\text{l}$  TaqMan universal PCR master mix 2-fold (AB applied Biosystem), RT-PCR reactions were performed in a final volume of 25  $\mu\text{l}$ . Real-time RT-PCR was performed using the TaqMan Gold RT-PCR kit (Applied Biosystems) with the MX3000 system.

Thermal Profile of amplification:  $48^{\circ}\text{C}$  – 30 min (reverse transcriptase step) followed by  $95^{\circ}\text{C}$  – 10 min,  $95^{\circ}\text{C}$  – 15 sec,  $60^{\circ}\text{C}$  – 60 sec for 40 Cycles.

The Student's t-test was used to compare continuous variables and the  $\chi^2$ -test or Fisher's exact test was used to compare proportions. Linear correlation was used to correlate the quantitative results between saliva and serum. A p value of 0.05 or less was considered significant.

## 3. Results

The 40 patients enrolled in the current study were all serum HCV RNA positive. The viral load in the study group was ranging from  $1.1 \times 10^4$  IU/ml to  $1.9 \times 10^6$  IU/ml. All the patients were HBsAg negative. None of them was on antiviral therapy.

Risk factors for HCV were identified in all patients. Dental treatment was the main risk factor reported (85.0 %), followed by previous surgeries (57.5%), history of parenteral anti-bilharzial treatment (27.5 %), positive HCV family member (22.5 %), and blood transfusion (20.0 %). None of the patients was a habitual alcohol consumer or an intravenous drug user.

HCV RNA was found in 17 out of the 40 saliva specimens (42.5 %), obtained from the patients. No statistical significant relation was found between the detection of HCV RNA in the saliva and age, sex, p values were  $> 0.05$  and the different dental treatments as risk factors, p values were  $> 0.05$ . (Table 1).

Regarding the 17 cases of positive HCV RNA in the saliva, the viral load in the saliva was ranging from  $1.1 \times 10^3$  IU/ml to  $1.3 \times 10^5$  IU/ml (with a mean of  $3.4 \times 10^4 \pm 3.3 \times 10^4$  IU/ml). There was no correlation between viral load in the serum and viral load in saliva,  $r = 0.242$ ,  $p = 0.350$ . Also, there was no statistically significant relationship between serum HCV RNA viral load and the detectability of HCV RNA in the saliva,  $p = 0.213$ . (Table 2)



**Table (1): Relation between detection of HCV RNA in the saliva and different dental treatments.**

Variables	HCV-RNA in saliva		<i>p</i> value
	Positive N = 17 (42.5 %)	Negative N = 23 (57.5 %)	
• <i>No dental treatment</i>	1 (16.7 %)	5 (83.3 %)	0.562
• <i>Dental treatment</i>			
- Extraction	5 (35.7 %)	9 (64.3 %)	
- Scalling	0 (0 %)	1 (100 %)	
- Restoration	2 (66.7 %)	1 (33.3 %)	
- Combined treatment	9 (56.3 %)	7 (43.7 %)	

**Table (2): Correlation between Serum HCV viral load and the detectability of HCV RNA in saliva**

Variable	HCV-RNA in saliva		<i>p</i> value
	Positive N = 17	Negative N = 23	
• <i>Range IU/ml (median)</i>	$1.1 \times 10^4 - 1.5 \times 10^6$ ( $1.8 \times 10^5$ )	$1.6 \times 10^4 - 1.9 \times 10^6$ ( $3.6 \times 10^5$ )	0.213

Out of the 40 HCV RNA positive patients, 17 cases were HCV RNA positive in saliva of them 13 cases (76.5 %) had no oral lesions, 4 (23.5%) cases had oral lesions. On the other hand, out of the 23 HCV RNA negative cases, 22 cases (95.6 %) had no

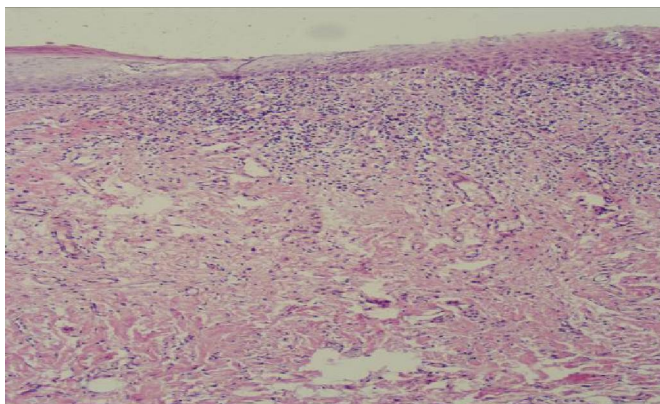
oral lesions and one case (4.3 %) had oral lesions. (Table 3).

These results showed that there was no statistical significant relation between HCV detection in saliva and the presence of oral lesions,  $\chi^2 = 4.516$ ,  $p = 0.341$ .

**Table (3): Relation between detection of HCV RNA in the saliva and presence of oral lesions.**

Variables	HCV-RNA in saliva		<i>p</i> value
	Positive N = 17	Negative N = 23	
• <i>No oral lesions</i>	13 (76.5 %)	22 (95.6 %)	0.341
• <i>Oral lesions</i>	4 (23.5%)	1 (4.3 %)	

**Macrograph (1) Showing severe atrophic glossitis and angular cheilitis in erosive lichen planus patient.**



**Micrograph (2) Showing erosive lichen planus showing thin surface epithelium and subepithelial lymphocytic band (H&E x100).**

#### 4. Discussion

The potential role of human saliva as a source of HCV infection has raised a 10-years debate, implying that dentists have an increased risk of exposure to HCV<sup>(16)</sup>. Detection of HCV RNA is indicative of the presence of HCV particles in the saliva, which may establish saliva as a potential vehicle of infection and confirm the possibility of a non-parenteral route of HCV transmission<sup>(1)</sup>.

In the study group, the main risk factor for HCV infection was the dental treatment (85.0%), followed by history of previous surgery (57.5%), history of parenteral anti-bilharzial treatment (27.5 %), positive HCV family member (22.5 %), and blood transfusion (20.0 %). None of the patients was a habitual alcohol consumer or an intravenous drug user. HCV RNA was detected in the saliva of 17 out of them (42.5 %). Studies on chronic HCV patients revealed detection rate ranging from 48 – 65% % that was in agreement with the result of the current study<sup>(16-19)</sup>.

Grossmann *et al.*,<sup>(20)</sup> demonstrated no statistical significance between stimulated and unstimulated methods for HCV RNA detectability in the saliva. In the current study whole unstimulated saliva was collected by spitting technique.

The majority of the studies to detect HCV in saliva used whole saliva to detect HCV RNA<sup>(1,16,19,20)</sup>. Whereas, information about the presence of HCV RNA in the different fractions of saliva (whole, supernatant and cell fraction) has been provided in few studies<sup>(14,17,21)</sup>. It was reported that there was no significant difference in virus detectability between different saliva fraction. In the current study HCV RNA was detected in the supernatant fraction.

The relation between HCV RNA titers in serum and the presence of HCV RNA in saliva has not been completely clarified; as few reports reported

that the best predictive factor for the high levels of HCV in saliva was the high levels of serum HCV RNA<sup>(17,19,22)</sup>. In the present study no correlation was found between the quantitative level of HCV RNA in serum and the presence of HCV in saliva. This is in agreement with Roy *et al.*<sup>(18,21)</sup> and Lins *et al.*<sup>(1)</sup>.

In the present study no correlation was found between serum viral load and HCV viral load in saliva. These findings were in agreement with Rey *et al.*<sup>(16)</sup>. On the other hand, they found a correlation between serum viral load and HCV RNA positivity in saliva, such correlation was reported by other workers<sup>(17,19,22)</sup>. In the current study no correlation was found between serum viral load and HCV RNA positivity in saliva. A possible explanation could be attributable to the large volume 560 µl used for RNA extraction from saliva samples which increased the possibility of HCV RNA detection in the saliva of patients with low serum viral load.

Despite these contradicting results, the most common finding was a lower HCV RNA titer in saliva compared to that in serum<sup>(17)</sup>. This could designate the source of HCV RNA in the saliva, as there might be continuous transudation of serum into the mouth from the gingival crevice *via* concentration gradient<sup>(1)</sup>. A finding that was supported by the presence of HCV RNA in the gingival crevicular fluid<sup>(23,24)</sup>. This theory was supported by the findings that salivary genotypes were the same as that of the blood<sup>(1,5)</sup>. (transudation from general circulation, or active replication in salivary gland epithelial cells). However, viral spillover from blood is another confirmed source. HCV RNA was detected in all saliva fractions tested and from homeostatic gauze that was used to stop bleeding in chronic HCV patients after surgery and scalling<sup>(14,25)</sup>. The issue of intraglandular replication of HCV remains controversial. Laskus *et al.*,<sup>(26)</sup> found HCV

quasispecies in different tissue samples compatible with independent replication at extrahepatic sites which could include major salivary glands.

The present study did not report significant relation between the presence of oral lesions and the detectability of the virus in the saliva. In contrast, Farghaly *et al.*<sup>(27)</sup> demonstrated that periodontitis and the bad oral hygiene of the Egyptian population are associated with the detectability of hepatitis markers in the saliva.

The present study investigated the prevalence of OLP in HCV infected patients, and it revealed 3 patients out of 40 (7.5 %) had OLP. The studies that investigated the frequency of OLP among HCV positive patients showed that from 0 to 20% of the HCV patients may have OLP<sup>(28-31)</sup>. This wide variation in the studies results may be attributed to geographic distribution of HCV infection worldwide. It would be expected that OLP prevalence will be high in countries where HCV is endemic.

Studies from Japan reported high OLP prevalence (8.5%) in one of the hyperendemic region of HCV infection<sup>(30)</sup>. This is in agreement with the current study as Egypt has the highest seroprevalence of HCV worldwide. However, the prevalence reported in the current study is higher than expected, especially with low OLP prevalence in the general Egyptian population reported by Ibrahim *et al.*,<sup>(32)</sup> 0.169 % in 1999. Other factors, such as sample size, diagnostic criteria of OLP and the age of the examined HCV patients should be taken into consideration.

Epidemiological studies need large sample size to generalize their results on the population. Another relevant issue is that the antiviral therapy of HCV infected patients. It has been suggested that interferon- may induce or modify the manifestations of OLP<sup>(33)</sup>. Thus, to exclude possible false positive results, the present study did not enroll patients on antiviral therapy.

The possibility of the saliva to be a potential vehicle for non-parenteral transmission of HCV remains also unclear. Multiple factors contribute to the infectivity of saliva, including the presence of intact and infectious viral particles, the viral titer, and the presence of appropriate target cells in the exposed area of the uninfected individual. Epidemiologic data do not support the concept that HCV is efficiently transmitted through saliva. However, toothbrushes have been implicated as a vehicle for HCV transmission.

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