The Effect of Ergonomic Intervention Program on Neck Pain among Computer Employees at a Communication Company in Zagazig City

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Abstract: Background: work- related neck disorders are a major health problem in many occupations, so many epidemiological studies dealing with them. The objectives of this study to determine the prevalence of neck pain among communication company employees, to explore some socio demographic and occupational risk factors of neck pain, to plan for an ergonomic health education and physical exercise programs and to evaluate the effect of this program after 3 months using the same pre- test questionnaire. Subjects and methods: This study was carried out at a governmental communication company in Zagazig city. One hundred and thirty employees were randomly selected from the workstations and were subjected to a pre-constructed questionnaire included socio demographic, occupational and Ergonomic features in the workplace. An ergonomic educational program was applied after addressing the Northwick neck pain questionnaire to measure neck pain and the consequent patient disability. Evaluation of the program was done after 3 months. Results: The mean age of the participants was 42.75± 9 years, 55.4 % were females, 80% were married and 91.5% were nonsmokers. The percentage of chronic headache was 24.6%, the majority of them had psychosocial troubles (70.8%). Neck pain prevalence was 61.5%. The present study revealed that body mass index had significant association with neck pain ($p < 0.05$). Also duration of employment duration, chronic headache, psychosocial troubles and boring work had significant association with neck pain. After application of the ergonomic health education program the change in monitor level and keyboard position had statistically significant difference. Neck pain had also improved among communication employees after application of muscular exercise program .Conclusion: current study concluded that there was a relationship between neck pain among computer users and some risk factors as duration of employment, body mass index. Exercises can reduce neck pain among computer employees. Recommendation: application of periodic ergonomic health education programs for refreshing employees knowledge and provide new employees with required knowledge also physical exercise program should be a part of daily work schedule. Further researches should be focused on risk factors of neck pain among computer employees.

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1. Introduction

Computers have become ubiquitous in the workplace. In Australia, 66% of all adults use a computer at home and at work (Australian Bureau of statistics, 2001), and in Sweden, about 65% of the workforce used a visual display unit (VDU) at work (Wahlstrom, 2005). Work at a VDU is a complex, dynamic and multifaceted interaction of the worker with various dimensions of the physical and psychosocial work environment (Johnston et al., 2008).

Work- related neck disorders are common problems in office workers especially among those who are intensive computer users(Bernard et al., 1999). A high prevalence of neck and upper limb complaints in computer using office workers has been reported in both eastern and western countries (Siu and Chan., 1998 and Tittiranonda *et al*., 1999).

Ergonomics studies have often examined the muscle load in healthy pain free subjects and assumed that higher levels of muscle activity during work represented higher risks for developing muscular skeletal discomfort (Klenine *et al*., 1999).

The etiology of neck pain is multifactorial, and the interactions of these various factors may cause different reactions in individuals when they are exposed to different physical and psychosocial stresses (Kumar., 2001 and Forde *et al*., 2002)

Appropriate use of computer workstations through specific ergonomics training intervention program can help in reduction of physical discomfort arising from using computer for long hours which is achieved by adjusting the seating and the operator's posture, the relation of operator to the key- board and the screen to prevent discomfort (Refat *et al*., 2006).

The aim of this study was to promote the health of computer users as regard neck pain with the following

objectives:

1- To determine the prevalence of neck pain among communication company computer employees
2- To explore some sociodemographic and occupational risk factors of neck pain
3- To plan for an ergonomic health education and physical exercise programs.
4 - To evaluate the effect of this programs after 3 months using the same pre- test questionnaire.

2. Subjects and Methods

Study setting:

This study was carried out at the governmental company for communication in Zagazig city, in the period from March 2011 to August 2011. The study took place at different office locations. In general the work places consisted of long hallways with private offices with fixed work surfaces heights and monitors and minimally adjustable chairs.

Sample selection:

Selection criteria were applied on computer using employees according to the definition of National Institute of Environmental Health Sciences (1996) which defined the computer operator as the person whose job duties require continuous use of computer for more than 3 hours per day or more than 20 hours per week.

Sample size was calculated at significant level 95% and power 80% with neck pain prevalence 49% (Refat *et al*., 2006) among exposed and prevalence of 24% (Bansevicus *et al*., 1997) among non-exposed using Epi- info version 6 to be 130 exposed employees. The studied individuals was randomly selected from the company's workstations and fulfilling the previously mentioned criteria.

Study design:

This study was divided into two phases:

Cross-Sectional study: was implemented through filling pre- constructed questionnaire sheets which included the following items:

1- Personal data (age, sex , education) and measure height (m^2) and weight (Kg) to calculate body mass index "BMI"

Occupational history: as, duration of employment and work boring; which defined as tedious, frequent, repetitive and with long hours job (Landsbergis,2010).

Psycho- social factors affecting work as, lack of support from colleagues and supervisors, high quantitative demands at work (Larsson *et al*., 2007).

Co-morbidity e.g. hypertension, diabetes and osteoarthritis. Chronic headache which defined as repeated episodes of discomfort beneath the scalp or forehead or behind the eyes over weeks to months (Sapt, 1990).

Ergonomics features in workstations which includes assessment of the computer operator "chair- footrest- monitor- keyboard position and keyboard fixation".

Neck pain was assessed by asking about neck pain during the preceding month (Mantyselka *et al*., 2010).

The presence of neck pain was dichotomized:

- Absent "no neck pain or neck pain only occasionally".
- Present "daily or almost daily occurring neck pain"

Interventional study:

1- An ergonomic healthy education program was designed aiming at raising knowledge about safe work practice through a message introduced to the studied computer operators about the right manner of safe ergonomic practice accompanied with illustration of ergonomic posture for computer users which is advised to be as following:

* Top of monitor at or just below eye level.
* Shoulder relaxed, and elbows close to body.
* Arm supported and wrists in line with forearms and feet flat on the floor. (Brisson *et al*., 1999)

Northwick - Neck pain questionnaire to measure neck pain and consequent patient disability. The questionnaire provides a subjective measure for monitoring symptoms overtime. It was developed at Northwick park Hospital in Middlesex England (Leak& Cooper, 1994) including the following (9) items:-

1- Neck pain intensity, 2- Neck pain and sleeping, 3- Pins and needles or numbness in the arms at night; 4- Duration of symptoms, 5- Carrying things. , 6- Reading and watching television, 7- Working and/ or housework, 8- Social activities and 9- Driving own car

The question on driving was omitted because only five subjects using their own cars so, 8 questions were answered, each item takes score = 4, so the maximum NPQ score equals 32, then NPQ Percentage was computed for neck pain score/ 32 as a percent

- The percentages range from 0 to 100%.
- The higher the percentage the greater the disability.
- The cutoff point of the data was taken according to quartiles:

< 25% no disabilities, 25-50% mild disabilities, 50-75% moderate disabilities, >75%severe disabilities

Severe and moderate neck pain cases excluded from muscular exercise prevention program (20 cases) included 3 drop out cases and advised to visit specialist doctors for proper management and treatment.

3- Muscular exercise program had the following criteria: it was performable while subject at work station, break of few minutes should be required and exercise simple, safe, easy to learn. Neck training exercises were illustrated via posters and the

participants were advised to continue self -neck training to improve the physical capacity of the neck and shoulder muscles (Hamberg-van *et al*., 2006 and OSHA, 2010).

4-Evaluation of the program was done after 3 months by using the same pretest questionnaire. % of change =

$$\frac{\text{Post test result value} - \text{pre test result value}}{\text{Pre test result value}} \times 100$$

Ethical considerations were respected. The participants were told about the aim of the study, ethical approval for this study was granted by ethical committee of faculty of medicine, Zagazig University. An informed consent was obtained from all participants in this study and the right to refuse participation was emphasized and a permission was taken from the company's managers.

Statistical Analysis:

Data were collected, coded, entered and were analyzed using (Statistical package for social science). SPSS (Norusis, 1997) program version (11). Independent variables were analyzed descriptively by frequency distribution and mean ± standard deviation. Chi square and Fisher's exact test were used to test the significance of qualitative variables as appropriate while independent samples t-test was used to compare means. McNemar test was used for evaluation of ergonomic and physical exercise programs regarding pre and post-test intervention. p value ≤ 0.05 was considered statistically significant.

3. Results

Table (1): Illustrated some socio demographic characteristics of studied group, 130 participants in this study showed mean age of 42.75 ± 9 years. The majority of participants were married (80%) and non-smokers (91.5%) Regarding residence, 51.5% of them live in urban area and 63.1% of them have university education.

On studying medical status, table (2) showed that the percentage of chronic headache was 24.6% and 36.9% of them suffer from co - morbidity. The majority of studied group had psychosocial troubles (70.8%).

Figure I showed that the percentage of neck pain among the participants was 61.5%.

Figure II illustrated that 75% of neck pain suffered from mild neck pain, while 22.5% had moderate neck pain and 2.5% had severe neck pain

Figure III illustrated that the pain lasted for one hour or less per day among 57.5% of Communication employees and for more than one hour per day among 42.5% of them.

On studying the association of socio demographic characteristics, medical status and occupational factors with the prevalence of neck pain among communication employees .Table (3) showed that age of employees, body mass index (BMI) had significant association with neck pain prevalence ($p < 0.05$).

Regarding duration of employment, work boring, chronic headache and psychosocial troubles had significant relation with neck pain ($p < 0.05$).

Table (4); revealed that the positive ergonomic changes in the studied computer work station that done by communication employees after application of the ergonomic health education program. The difference in monitor level and keyboard position was statistically significant, while chairs, footrest on floor and keyboard flexibility showed non-significant difference $p > 0.05$.

Table (5) Showed that the mild neck pain had improved among communication employees after application of muscles exercise program ($p < 0.05$).

Table (1) Some socio demographic characteristics of communication company computer employees

Variables			Communication group(n=130)	
Age ($\bar{x} \pm SD$)			42.75± 9	
Sex	Males	No %	58	4 4.6
	Females	No %	72	55.4
Residence	Rural	No %	63	48.5
	Urban	No %	67	51.5
Education	Secondary	No %	48	36.9
	University	No %	82	63.1
Marital	Unmarried	No %	26	20
	Married	No %	104	80
Smoking	Non-Smoker	No %	119	91.5
	Smoker	No %	11	8.5

Table (2): Distribution of some medical complaints among communication company computer employees.

Variables			Communication computer group(n=130)	
Ch. Headache				
Yes	No	%	32	24.6
No	No	%	98	75.4
Psychosocial troubles				
Yes	No	%	92	70.8
No	No	%	38	29.2
Co morbidity				
Yes	No	%	48	36.9
No	No	%	82	63.1

Table (3):Some risk factors of neck pain among communication company computer employees.

Variables	Neck pain Yes (N= 80)	No (N= 50)	Test of Significance	p
Age ($\overline{X} \pm SD$)	44.9 ± 8.7	39.2± 8.3	13.8	< 0.05
BMI ($\overline{X} \pm SD$)	30.1± 4.7	28.2 ± 4.1	5.5	< 0.05
Duration of employment ($\overline{X} \pm SD$)	17.5 ± 9	13.6 ± 6.6	7	< 0.05
Sex Male	34 58.6	24 41.4	0.38	> 0.05
Sex Female	46 63.9	26 36.1		
Residence Rural	40 63.5	23 36.5	0.2	> 0.05
Residence Urban	40 59.7	27 40.3		
Education Secondary	32 66.7	16 33.3	0.85	> 0.05
Education University	48 58.5	34 41.5		
Smoking Non- smoker	71 59.7	48 40.3	*	> 0.05
Smoking Smoker	9 81.8	2 18.2		
Co- morbidity Yes	34 70.8	14 29.2	2.78	> 0.05
Co- morbidity No	46 56.1	36 43.9		
Psychosocial Yes	62 67.4	30 32.6	4.56	<0.05
Psychosocial No	18 41.4	20 52.6		
Boring work Yes	60 76.9	18 23.1	19.5	< 0.05
Boring work No	20 38.5	32 61.5		
Chronic headache Yes	26 81.3	6 18.7	6.9	< 0.05
Chronic headache No	54 55.1	44 44.9		

- Fisher exact test

Table (4): Ergonomic changes among communication company computer employees before and after application of health education program.

Ergonomic tools	Before (127)	After (127)	% of changes	P
Chair	53	59	11. .3 %	> 0.05
Foot rest	79	84	6. 3 %	> 0.05
Monitor level	76	98	28. 9%	< 0.05
Keyboard position	67	88	31. 3%	< 0.05
keyboard flexibility	71	76	7%	> 0.05

p value was computed by using McNemar Chi-square Test

Table (5): Neck pain among communication company computer employees before and after Application of muscular exercise program

Variable	Before	After	% of changes	p
Mild neck pain	60	41	31.6	< 0.05

p value was computed by using McNemar Chi-square Test

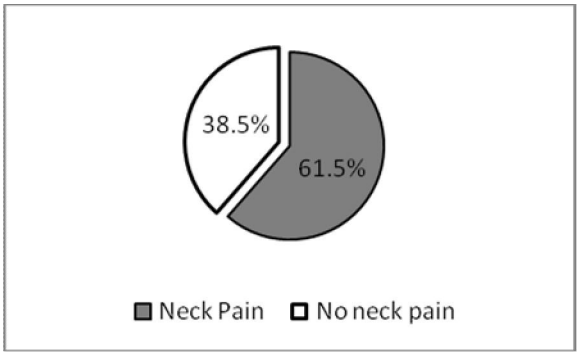
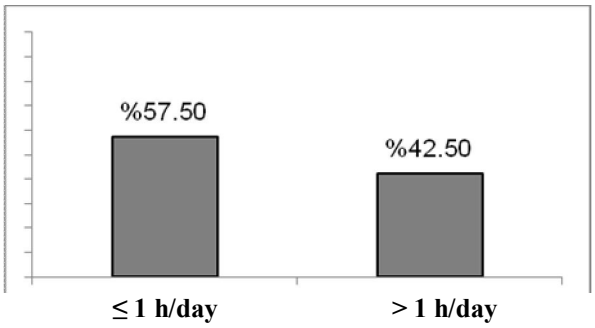


Figure I: Pie chart illustrates neck pain prevalence among communication company computer employees.

Figure II :Bar chart shows the disabilities due to neck pain among communication company computer employees.



Figures III: Daily duration of neck pain among communication company computer employees

4.Discussion

In recent decades, work- related musculoskeletal disorders among computer users are receiving a growing attention. The current study included 130 participants of computer operators of a communication company. About 55.4% of them were females and 44.6% were males, the mean age of both is 42.75 ± 9 years, the majority of participants are married, non-smokers and 63.1% were university educated and 58.5% living in urban area.

Figure I revealed that 61.5% of studied computer operators complained from neck pain. The same finding was declared by El-tayeb *et al*., 2008, and Johnston *et al*., 2008). But inconsistent with Brazilian call center operators (Rocha *et al*., 2005 and Refat *et al*., 2006) who found that neck pain among their studied group was 49.2%.

The most participants suffered from neck pain had mild pain and disabilities (75%), while 22.5% had moderate pain and disabilities and only 2.5% had severe pain and disability., this was inconsistent with results of El- Tayeb, *et al*., 2008, and Johnston, *et al*., 2008 who found that 53.8% of their studied group experience mild neck pain and disabilities, 14% had moderate pain and disabilities and only 0.9 experience severe pain and disabilities.

On studying some risk factors of neck pain among computer employees of communication company, this study revealed that mean age of neck pain group was greater than those free from neck pain and the difference was statistically significant ($p < 0.05$), this finding agreed with Brand *et al*.(2004) as the effect of age on neck pain was peaked in the fourth and fifth decades of life.

Regarding body mass index, the mean of BMI was 30.1 ± 4.7 among computer employees of Communication Company complaining from neck pain compared with 28.2 ±4.1 among neck pain free employees of the same company and the difference was statistically significant ($p< 0.05$). This agreed with a study done by Luime *et al*.(2004) who found significant association between neck pain and body mass index.

Table (3): revealed that sex, residence, level of education, marital status and smoking did not have any significant association with neck pain

As regard sex the present finding agreed with Luime et at.,(2004), but disagreed with El- Tayeb *et al*.(2008)who reported that females experience neck pain were significantly more than males. This could be explained by different job duties of both sex, as the females worked mainly on computer while males could do other work beside their work on computer.

Also in the present study the marital status had no association with neck pain $p > 0.05$. This result consistent with Luime *et al*., 2004.

Regarding education the present study announced that the level of education had no effect on neck pain, this finding agreed with Gerr *et al*.(2002)who reported that no effect of educational degree on neck pain. This can be explained as job duties are more or less the same at different education level among computer users

On studying smoking among computer operators in Communication Company there was no relation

between smoking and neck pain (p> 0.05). The same finding was approved by Erikson *et al*.(1999), but in another study it was found that smoking increased neck pain incidence (Korhonen *et al*., 2003). The possible explanation of this finding was that the majority of computer operators in communication company were non- smokers.

On studying chronic headache among communication employees there was a significant difference between group complaining of neck pain and neck pain free group (p < 0.05). This finding agreed with Erikson *et al*. (1999), who found a significant association between neck pain and headache .There was consistent evidence that neck pain coexist with other health problems as headache.

The majority of studied communication group had psychosocial troubles (70.8%). This result agreed with Erikson *et al*.(1999) ,Cassou *et al*. (2002), and Devereux *et al*. (2002) who reported that workers who had psychosocial troubles were more likely to develop neck pain.

Regarding duration of employment , the present study illustrated that these was a significant association between neck pain and employment duration (p < 0.05). This agreed with a study done by Viikari- Juntura (1994) who suggested that long employment duration had a significant effect on the experience of neck pain. This could be explained by ageing process and muscular strain due to computer uses .

The present study found that, Boring of work had significant relation with occurrence of neck pain among employees of communication company (p<0.05).This finding agreed with study done by Johnston *et al*.(2008).

On describing the ergonomic changes which have been done by communication employees in their work place from before to after the application of ergonomic health education intervention program, table (4) illustrated that changes in monitor level and keyboard position were statistically significant (p< 0.05) . this was in accordance with Refat *et al*.(2006) .This finding could be explained by that the change in position of monitor and keyboard are easy to be done

The current study approved that mild neck pain improved significantly after application of muscular exercise program by communication company employees (p< 0.05). This agreed with a study done by Nevala- puranen *et al*.(2003), who found that musculoskeletal pain was improved among newspaper employees after application of an exercise program for upper limbs and changes in work technique.

Neck pain taskforce report that exercise was found to be effective intervention of neck pain and that workers who exercised had a better prognosis for recovery from neck pain (Carroll *et al*., 2008).

Conclusion

The current study concluded that there was a relationship between neck pain among computer users and some risk factors as, duration of employment , body mass index, boring work, psychosocial troubles and chronic headache. Application of Ergonomic Education program and neck physical exercises can reduce neck pain among computer users.

Recommendation:

Application of periodic health education programs for refreshing employees knowledge and provide new employees with required knowledge also physical exercise program should be a part of daily work schedule. Further researches should be focused on multiple risk factors of neck pain among computer users.

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