

## Some Occupational Health Problems among Poultry Farm Workers in Sharkia Governorate: An Epidemiological Study

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**Abstract:** Background: The atmosphere in poultry farms usually contains significant levels of agricultural dust and toxic gases, which put the workers at a health risk. Objectives: 1-To determine the prevalence of some occupational health problems among poultry farm workers and their determinants.2-To study the work environment by assessing dust concentration level and its effect on the health of the exposed workers.3-To propose recommendations for occupational safety at poultry farms. Methods: a comparative cross sectional study was conducted among 222 male workers divided into two groups: The exposed group consisted of 110 poultry farm workers working in 63 poultry farms in Diarb Nigm city and Comparable control group consisted of 112 workers from ready- made clothes factory. Data were collected by a pre-designed questionnaire, clinical examination and laboratory investigation. Results: self-reported health complaints among poultry farm workers were ocular complaints (55.4%), followed by gastrointestinal (48.2%), respiratory (41.8%), and dermatological (38.1%) complaints. The prevalence of nasal irritation, sneezing, throat irritation and chest tightness were significantly higher among the Poultry farm workers (21.8%, 20.9%, 27.2%, 15.4% respectively) compared to control group. Also, prevalence of chronic cough, chronic phlegm, chronic bronchitis and bronchial asthma were significantly higher among poultry farm workers (39.09%, 38.18%, 16.3%, 6.3% respectively) compared to control group. Duration of work is a risk factor for respiratory symptoms (chronic and acute), while smoking is a risk factor for chronic respiratory symptoms. The frequency of obstructive and combined ventilatory function impairment among poultry farm workers (26.3%, 14.5%) are significantly higher compared to control group (8.9%, 5.35%). The prevalence of chronic dermatitis, onychomycosis and tinea pedis are significantly higher among exposed group (15.45%, 18.18% and 20% respectively) compared to control group (4.46%, 3.57% and 8.03% respectively). The prevalence of eye irritation & lacrimation, discharge and Foreign body is significantly higher among exposed group (22.7%, 14.4% and 54.54%) compared to control group (6.25%, 3.57% and 5.35%). Also The prevalence of Klebsiella and E-coli are significantly higher among exposed group (18.05% and 88.8%) compared to control group (1.755 and 14.03%). The mean concentration of respirable dust at poultry farms was (5.5±1.62). Conclusion: Poultry workers are at greatest risk of developing many health problems as respiratory, ocular, dermatological and gastrointestinal problems. recommendations: pre-placement and periodic medical examination, health education program, effective exhaust ventilation, and periodic environmental monitoring for better prevention for these health problems.

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**Key words:** Poultry farm workers – dust concentration- respiratory – gastrointestinal – ocular – dermatological.

### 1. Introduction

Poultry workers who spend the most time in poultry farms and therefore experience the greatest amount of exposure are at greatest risk. These include poultry caretakers, farm managers and flock supervisors. Another category of workers at risk include poultry catchers, who harvest the birds for transportation to processing plants<sup>(1)</sup>. The atmosphere in poultry farms usually contains significant levels of agricultural dust and toxic gases, which put the workers at a health risk<sup>(2)</sup>.

An individual's response to dust depends on many factors including nature duration of exposure level and particle size distribution of airborne exposure<sup>(3)</sup>. Exposure to organic dust is one of the most recognized respiratory hazards associated with

poultry production. Dust, bacteria, moulds, endotoxin and ammonia are considered central elements in daily exposure of agricultural workers<sup>(4)</sup>. These substances are known to cause allergic and non-allergic rhinitis, asthma, extrinsic alveolitis, organic dust toxic syndrome and can also induce chronic bronchitis<sup>(5)</sup>. Epidemiological studies showed increased prevalence of respiratory symptoms and adverse changes in pulmonary function parameters in poultry workers<sup>(6,7)</sup>.

Conditions in poultry plants expose workers to multiple agents affecting the skin, the number of skin ailments was expected to be high. Each worker had at least one dermatological diagnosis.

The most common infections were onychomycosis, (76%), tinea pedis (72%) followed by inflammatory

diagnosis acne (64%)<sup>(8)</sup>. Protective clothing should be used to prevent direct skin contact with contaminated materials and surfaces and reduce the likelihood of transferring contaminated material outside a poultry work site. Disposable protective clothing is preferred<sup>(9)</sup>.

#### **Objectives:**

1-To determine the prevalence of some occupational health problems among poultry farm workers and their determinants.

2-To study the work environment by assessing dust concentration level and its effect on the health of the exposed workers.

3-To propose recommendations for occupational safety at poultry farms.

#### **2. Subjects and Methods:**

To achieve these objectives, a comparative cross sectional study was conducted among 222 male workers divided in two groups: The exposed group consisted of 110 poultry farm workers working in 63 poultry farms in Diarb Nigm city and Comparable control group consisted of 112 workers from ready- made clothes factory. The sample size of the exposed group was calculated through Epi-Info, version 6 according to the total number of workers, the lowest prevalent symptoms among exposed was 25.5% the power of the study 80% at 95% confidence interval. An informed consent was taken from each participant shared in the study.

#### **Tools:**

##### **1- Questionnaire:**

**Specially designed questionnaire** was used to identify:

Socio-demographic data: include age, residence, educational level, marital status and special habits like smoking. Occupational history includes questions about:

- current job and nature of work
- previous and another jobs
- duration of work in the current job in years
- Health complaints: onset, course and duration

##### **2- Clinical examination**

Comprehensive skin examinations were performed with a special relevance to the exposed skin (upper and lower limbs) of the studied groups. Also, ocular examinations were performed to all participants.

##### **3- Investigations:**

###### **Stool culture:**

Stool samples from exposed and control groups were collected for microscopic examination and culture (72 from the exposed group and 57 from the control group).

#### **Chest X ray:**

Postero – anterior chest X ray was done for exposed and control groups.

#### **Ventilatory function assessment:**

All workers included in this study were subjected to ventilatory function assessment using a calibrated electronic spirometer (Datospir-120)

#### **Statistical analysis:**

Statistical analysis was done using SPSS software package version 16 using frequency distribution table, mean and standard deviation for descriptive purposes. Chi-square test for testing the significance of difference of qualitative variables, t-test was used for comparison between two group means. Logistic regression analysis was carried out to identify the significant risk factors. The level of significance was considered at  $< 0.05$ .

#### **3. Results**

The studied groups were matched in socio-demographic characteristics as mean age of poultry farm workers was  $32.6 \pm 9$  years old and mean age of control group was  $34 \pm 9.2$  years old. The mean duration of work was  $8.52 \pm 5.14$  and  $9.05 \pm 4.42$  for exposed and control groups respectively. Smokers were higher in both exposed (79.1%) and controls (83%) compared to nonsmokers (20.9% and 16.9% respectively). The majority of Both exposed and control lived in rural area (82.7% and 76.8%) and had school education (44.5% and 51.7%) and unmarried (62.7% and 58%) (Table 1).

Table (2) shows that self-reported health complaints among poultry farm workers were ocular complaints (55.4%), followed by gastrointestinal (48.2%), respiratory (41.8%), and dermatological (38.1%) complaints. Also (46.3%) of the exposed group had more than one complaint.

Table (3) shows that the prevalence of acute symptoms of work exposure as nasal irritation, throat irritation, sneezing and chest tightness (21.8%, 27.2%, 20.9% and 15.4% respectively), which were significantly higher among the exposed group compared to their control ( $P < 0.001$ ). also chronic symptoms (chronic cough, chronic phlegm, chronic bronchitis and bronchial asthma) are significantly higher among exposed (39%, 38.1%, 16.3%, 6.3% respectively) compared to control (25.95, 24.1%, 7.14% and 0.89% respectively). The frequency of obstructive and combined ventilatory function impairment among poultry farm workers (26.3% and 14.5%) are significantly higher compared to control group (8.9% and 5.35%). But, there was no statistically significant difference between poultry farm workers and control group as

regard the frequency of restrictive ventilatory function impairment.

Concerning dermatological disorders Table (4) shows that the frequencies of chronic dermatitis, onychomycosis and tinea pedis were significantly higher in the exposed (15.45%, 18.18% and 20% respectively) compared to control group (4.46%, 3.57% and 8.03% respectively). Regarding ocular complaints, ocular Foreign body was the most prevalent ocular complaint among the exposed (54.5%) compared to control group(5.3%). the prevalence of recurrent diarrhea and abdominal distension & cramps was significantly higher among the exposed (37.2% and 37.2%) compared to control group (7.1% and 17.8%).

Regarding stool culture findings, Table (5) shows the prevalence of klebsiella and *E-coli* was significantly higher among the exposed (18.05% and 88.8%) compared to control group (1.75% and

14.03%). As regard X-ray findings, There was no statistically significant difference of the frequency of Prominent bronchovascular markings and localised fibrotic changes among poultry farm workers and their control group.

Table (6) shows that, the mean respirable dust concentration in poultry farms was significantly higher ( $5.5 \pm 1.62 \text{ mg/m}^3$ ) than that of Clothes factory sections ( $0.23 \pm 0.0362 \text{ mg/m}^3$ ).

Logistic regression analysis of positive predictors reveals that the duration of work was the most important risk factor for respiratory symptoms (chronic and acute), Ventilatory function impairments and Chronic dermatitis. Also, smoking was a risk factor of both chronic respiratory symptoms and Ventilatory function impairments. While positive stool culture was a risk factor of gastrointestinal complaints (Table 7).

**Table (1):Socio-demographic characteristics of poultry farm workers exposed to poultry dust and control group.**

General characteristics	Exposed group N=110	Control group N=112	P-value
<b>Age (y)</b> (X ± SD)	32.6 ± 9	34±9.2	>0.05
<b>Duration of work (y)</b> (X ± SD) Median Range	8.52±5.14 7 (1 – 23)	9.05±4.42 9 (2 – 16)	>0.05
<b>Smoking habit</b> Smoker No (%) Non-smoker No (%)	87 (79.1) 23 (20.9)	93 (83.03) 19 (16.9)	>0.05
<b>Residence</b> Urban No (%) Rural No (%)	19 (17.3) 91 (82.7)	26 (23.2) 86 (76.8)	>0.05
<b>Educational level</b> Illiterate No (%) Read and write No (%) School education No (%) Higher education No (%)	4 (3.6) 42 (38.18) 49 (44.5) 15 (13.6)	2 (1.78) 35 (31.25 ) 58 (51.78) 17 (15.17)	>0.05
<b>Marital status</b> Married No (%) Unmarried No (%)	41 (37.3) 69 (62.7)	47 (42) 65 (58)	>0.05

**Table (2): Frequency distribution of health complaints among poultry farm workers and control group.**

Health complaints	Exposed group N=(110)		Control group N=112		$\chi^2$	P-value
	No	%	No	%		
Respiratory complaints	46	41.8	32	28.5	4.27	<0.05
Dermatological complaints	42	38.1	13	11.6	21.02	<0.001
Musculoskeletal complaints	17	15.4	38	33.9	10.16	<0.001
Ocular complaints	61	55.4	9	8.03	57.79	<0.001
Ear complaints	33	30	39	34.8	0.58	>0.05
Gastrointestinal complaints	53	48.2	21	18.7	21.6	<0.001
More than one complaint	51	46.3	38	33.9	3.57	>0.05

**Table (3): Distribution of acute, chronic respiratory symptoms and Ventilatory function impairment among poultry farm workers and control group**

Variables	Exposed group N=110		Control group N=112		$\chi^2$	P-value
	No	%	No	%		
<b>Acute</b>						
Nasal irritation	24	21.8	5	4.46	14.76	<0.001
Sneezing	23	20.9	5	4.46	13.616	<0.001
Throat irritation	30	27.2	13	11.6	8.72	<0.01
Chest tightness	17	15.4	6	5.35	6.093	<0.01
<b>Chronic</b>						
Ch. Cough	43	39.09	29	25.9	4.41	<0.05
Ch. Phlegm	42	38.18	27	24.1	5.132	<0.01
Ch. Bronchitis	18	16.3	8	7.14	4.563	<0.05
Dyspnea	10	9.09	7	6.25	0.633	>0.05
Chest wheeze	14	12.7	10	8.92	0.831	>0.05
Bronchial asthma	7	6.3	1	0.89	*	<0.05
<b>Ventilatory function impairment</b>						
Obstructive (N=39)	29	26.3	10	8.9	11.6	<0.001
Restrictive (N=9)	7	6.3	2	1.78	2.9	>0.05
Combined (N=22)	16	14.5	6	5.35	5.2	<0.01

\* fisher exact test.

**Table (4): Distribution of dermatological, ocular and gastrointestinal disorders among poultry farm workers and control group**

Variables	Exposed group N=110		Control group N=112		$\chi^2$	P-value
	NO	%	NO	%		
<b>dermatological disorders</b>						
Chronic dermatitis	17	15.45	5	4.46	7.508	<0.01
Onychomycosis	20	18.18	4	3.57	12.2	<0.001
Tinea pedis	22	20	9	8.03	6.61	<0.01
Warts	3	2.72	1	0.89	*	>0.05
<b>ocular complaints</b>						
Eye irritation & lacrimation	25	22.72	7	6.25	12.21	<0.001
Redness	16	14.45	8	7.14	3.15	>0.05
Discharge	16	14.45	4	3.57	8.15	<0.01
Foreign body	60	54.54	6	5.35	64.27	<0.001
<b>Gastrointestinal complaints</b>						
Recurrent diarrhea	41	37.2	8	7.1	29.2	<0.001
Abdominal distension & cramps	41	37.2	20	17.8	10.49	<0.001
Epigastric pain	16	14.5	9	8.2	2.3	>0.05

\* fisher exact test.

**Table (5): Frequency distribution of stool culture and X-ray findings among poultry farm workers and control group**

Variables	Exposed group N=72		Control group N=57		$\chi^2$	P-value
	NO	%	NO	%		
<b>Laboratory study findings</b>						
Klebsiella	13	18.05	1	1.75	*	<0.001
E-coli	64	88.8	8	14.03	72.2	<0.001
Mixed infection	3	18.05	1	1.75	*	<0.001
<b>Chest X-ray findings</b>						
Prominent bronchovascular markings	28	38.8	13	22.8	3.79	>0.05
Localised fibrotic changes	3	4.16	1	1.75	*	>0.05

\* fisher exact test.

**Table (6): Mean, standard deviation and range of respirable dust concentrations in poultry farms and clothes factory sections.**

Respirable dust mg/m <sup>3</sup>	Work place		t- test	p-value
	Poultry farms	Clothes factory sections		
Range	2.58 – 11.12	0.19 – 0.28	34.31	<0.001
X ± SD	5.5 ± 1.62	0.023 ± 0.03		

**Table (7): Logistic regression of the significant risk factors predicting respiratory symptoms (chronic and acute), ventilatory function impairments, chronic dermatitis and gastrointestinal complaints among poultry farm workers**

Variables	B	SE	Wald	P- value
<b>Chronic respiratory symptoms</b>				
Duration of work	1.6	0.42	14.3	<0.001
Smoking	1.07	0.55	3.8	<0.05
<b>Acute respiratory symptoms</b>				
Duration of work	1.8	0.45	16.7	<0.001
<b>Ventilatory impairments</b>				
Duration of work	2.04	0.456	20.08	<0.001
Smoking	1.34	0.52	6.61	<0.01
<b>Chronic dermatitis</b>				
Duration of work	1.56	0.57	7.4	<0.01
<b>Gastrointestinal complaints</b>				
Positive stool culture	0.631	0.25	6.5	<0.01

#### 4. Discussion

Poultry farm workers are exposed to Poultry dust (mixture of organic and inorganic), chemicals and therapeutic additives which put the workers at a health risk to develop multi-system affection involving respiratory, dermatological, gastrointestinal, ophthalmological and musculoskeletal systems<sup>(6-8,10-12)</sup>.

Self-reported respiratory complaints among poultry farm workers was 41.8% while much higher percentage was reported among poultry workers by others<sup>(13,18)</sup>. The prevalence of chronic cough and chronic phlegm was higher among poultry farm workers (39.09% and 38.18%) than among control group. This is consistent with a study of 303 Canadian poultry farm workers found that chronic cough and chronic phlegm were 35% and 30%<sup>(14)</sup>. This explained by endotoxin levels in the poultry buildings which exceeded the threshold value for airways inflammation<sup>(7)</sup>. Also the prevalence of chronic bronchitis and bronchial asthma was higher among poultry farm workers (16.3% and 6.3%) compared to their control group (6.3% and 0.89). The mechanism of its occurrence could be due to dust in poultry houses contains several inflammatory agents as allergic fungi, which have many biologically potent components in the cell wall and cytoplasm<sup>(15)</sup>. Predominance of small poultry farms in this study was associated with less interest in following safety measures. Work overload and poor ventilation at the workplace increased the prevalence of acute symptoms of work exposure as nasal irritation, throat irritation, sneezing and chest tightness (21.8%, 27.2%, 20.9% and 15.4% respectively), which were significantly higher among the exposed group compared to their controls (P<0.001). the previous result could be attributed to high level of Ammonia which was considered an irritant and affect the eyes and respiratory tract<sup>(7)</sup>.

The frequency of obstructive and combined ventilatory function impairment (26.3% and 14.5%)

were significantly higher among poultry farm workers compared to control group (8.9% and 5.35%) which agreed with previous researches<sup>(14,16)</sup>.

The frequencies of chronic dermatitis, onychomycosis and tinea pedis were significantly higher among the exposed (15.45%, 18.18% and 20% respectively) compared to control group, but it is lower than previous researches<sup>(8, 17)</sup>.

The prevalence of eye irritation & lacrimation, discharge and Foreign body was significantly higher among the exposed group (22.7%, 14.4% and 54.54%) compared to control group (6.25%, 3.57% and 5.35%). Previous symptoms were correlated with exposure to total dust, fungal spores, and endotoxins<sup>(18)</sup>.

The prevalence of recurrent diarrhea and abdominal distension & cramps was significantly higher among the exposed, explained by the presence of high prevalence of campylobacter among poultry farm workers<sup>(19)</sup>.

The prevalence of klebsiella and E-coli was significantly higher among the exposed group (18.05% and 88.8%) compared to control group (1.75% and 14.03%). These results showed the role of supplementing feeds with antibiotics in the selection for multiple drug resistant microorganisms to persist in the population<sup>(11)</sup>.

No significant difference was observed in the findings of chest x- ray among the studied groups, these results disagreed with previous researches<sup>(20)</sup>.

OSHA Permissible exposure limit (PEL) was 5 mg/m<sup>3</sup> respirable dust in poultry farms<sup>(21)</sup>. The present study showed that the mean respirable dust concentration in poultry farms was (5.5±1.62 mg/m<sup>3</sup>) which exceed the standard recommended level. these results agreed with previous researches<sup>(22-24)</sup>.

Logistic regression analysis of positive predictors revealed that the duration of work was the most important risk factor for respiratory symptoms (chronic and acute), and Ventilatory function

impairments. This result coincided with Noertjojo<sup>(25)</sup> who stated that the long term occupational exposure to organic dusts places the workers at risk of developing Chronic pulmonary diseases. Also, smoking was a risk factor of both chronic respiratory symptoms and Ventilatory function impairments. Elmes<sup>(26)</sup> reported that smoking tends to aggravate chronic respiratory symptoms resulting from exposure to organic dust. In addition, the duration of work was a risk factor for chronic dermatitis which was in agreement with previous study<sup>(17)</sup>.

### Conclusions & Recommendations

Poultry workers are at greatest risk of developing many health problems where the most important were respiratory, ocular, dermatological, gastrointestinal problems. So it is recommended that pre-placement and periodic medical examination, health education program, effective exhaust ventilation, and periodic environmental monitoring for better prevention for these health problems.

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### Reference

- 1- NC State University (2002): Improving the health and safety of poultry facility workers. Available at <http://www.bae.ncsu.edu/programs/extension/index.html>
- 2- International Labour Organization (2002): International Hazard Datasheets on Occupational Poultry Farm Workers. Available at [http://www.ilo.org/public/english/protection/safe-work/cis/products/hdo/htm/farmr\\_poultry.htm](http://www.ilo.org/public/english/protection/safe-work/cis/products/hdo/htm/farmr_poultry.htm)
- 3- Niewenhuisen, M.J. (1999): 'Personal exposure to dust, endotoxin and crystalline silica in California agriculture' *Annals of Occupational Hygiene.*; 43:35-42.
- 4- Omland, O. (2002): 'Exposure and respiratory health in farming in temperate zones: A review of the literature' *Annals of Agricultural and Environmental Medicine.*; 9(2) 119-136.
- 5- Radon, K.; Danuser, B.; Iversen, M.; Jo'rres, R.; Monso, E. and Opravil, U. (2001a): Respiratory symptoms in European animal farmers. *Eur Respir J.*; 17:747-754.
- 6- Radon, K.; Weber, C.; Iversen, M.; Danuser, B.; Pedersen, S. and Nowak, D. (2001b): Exposure assessment and lung function in pig and poultry farmers. *Occup Environ Med.*; 58:405-410.

- 7- Rylander, R. and Carvalheiro, M.F. (2006): Airways inflammation among workers in poultry houses, *Int Arch Occup Environ Health.*; 79 pp. 487-490.
- 8- Quandt, S.A.; Schulz, M.R.; Feldman, S.R.; Vallejos, Q.; Marin, A.; Carrillo, L. and Arcury, T.A. (2005): Dermatological illnesses of immigrant poultry-processing workers in North Carolina. *Arch Environ Occup Health.*; 60(3):165-9.
- 9- Occupational Safety and Health Administration (OSHA) (2007): Safety and health topics: respiratory protection. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration. [www.osha.gov/SLTC/respiratoryprotection/index.html](http://www.osha.gov/SLTC/respiratoryprotection/index.html)
- 10- Donham, K.J.; Cumro, D. and Reynolds, S.J (2002): Synergistic effects of dust and ammonia on the occupational health effects of poultry production workers. *J Agromed.*; 8:57 - 76.
- 11- Gaede W (2008): 'Chlamydothila psittaci infections in humans during an outbreak of Psittacosis from poultry in Germany' *Zoonoses Public Health.*; 55 184-8.
- 12- Antonio, J.; Marn, M.A.; Joseph, G.; Grzywacz, D.; Thomas, A.; Arcury, P.; Lourdes, C.; Michae, L.; Coates, M.S. and Sara, A. (2009): Evidence of Organizational Injustice in Poultry Processing Plants: Possible Effects on Occupational Health and Safety Among Latino Workers in North Carolina *American Journal of Industrial Medicine.*; 52:37-48.
- 13- Davor, R.; Jelena, M.; Veda, M.V.; Marija, V.; Kristina, M.; Ljerka, P.; Tatjana, O.; Ivanc'ica, T. and Ivan, P. (2010): Exposure to poultry dust and health effects in poultry workers: impact of mould and mite allergens. *Int Arch Occup Environ Health.* 83:9-19.
- 14- Kirychuk, S.P.; Senthilselvan, A. and Dsman, J.A. (2003): Respiratory symptoms and lung function in poultry confinement workers in Western Canada. *Can Respir J.*; 10: 375 - 80.
- 15- Khosravi, A.R.; Naseri-Bandghorai, A.; Moazzeni, M.; Shokri, H.; Mansouri, P. and Mahmoudi, M. (2009): Evaluation of *Candida albicans* allergens reactive with specific IgE in asthma and atopic eczema patients. *Mycoses.* [http://www.science-direct.com/science?\\_ob=articleURL](http://www.science-direct.com/science?_ob=articleURL).
- 16- Stahuljak-Beritic, D.; Dimov, D.; Butkovic, D. and Stilinovic, L. (1997): Lung function and immunological changes in poultry breeders. *Int Arch Occup Environ Health.*; 40:131-139.
- 17- Arcury, S.R.; Feldman, M.R.; Schulz, Q.; Vallejos, A.; Verma, A.B.; Fleischer, J.; Rapp,

- S.F.; Davis, J.T.; Preisser, S.A. and Quandt(2007): Diagnosed Skin Diseases Among Migrant Farmworkers in North Carolina: Prevalence and Risk Factors *Journal of Agricultural Safety and Health.*; 13(4): 407-418.
- 18- Erik, M. and Wijnand, E. (2001): Organic Dust-Related Respiratory and Eye Irritation in Norwegian Farmers. *American Journal of Industrial Medicine.*; 39: 209-217.
- 19- Van Gerwe, T.J.; Bouma, A. and Jacobs-Reitsma, W.F. (2005): Quantifying transmission of *Campylobacter* spp. among broilers. *Appl Environ Microbiol.*; 71:5765– 5770.
- 20- Mackiewicz B(1998): Study on exposure of poultry farm workers to bioaerosols, immunologic reactivity and health effects. *Ann Agric Environ Med.*; 5: 169–175.
- 21- Occupational Safety and Health Administration (OSHA) (1997) : Poultry processing industry e tool. OSHA poultry survey form. <http://www.osha.gov/sltc/etools/poultry/oshasurvet.html>
- 22- Health and Safety Executive HSE(2005): Workplace exposure limits, ISBN 0-7176-2977-5.. <http://www.hse.gov.uk/coshh/table1.pdf>
- 23- Kadlec, K. and Hanslian, L. (1983) : Wood. In: *Encyclopedia of Occupational Health and Safety.* 3<sup>rd</sup> ed. Vol. II. Edited by Parmeggini, L.; I.L.O, Geneva.; pp: 2308-2316.
- 24- Whitehead, L.W. (1982): Health effect of wood dust relevance for an occupational standards. *AM. Ind. Hyg. Assoc. J.*; 43: 575-585.
- 25- Noertjojo, H.; Dimich-Ward, S.; Peeleh, M.; Dittrick, S.M. and Chan-Yeung, M. (1996): Western red cedar dust exposure and lung function: a dose-response relationship. *Am J Resp Care Med.*; 155: 130- 132.
- 26- Elmes, P.C.(1981): Relative importance of cigarette smoking in occupational lung disease. *Br J Ind Med.*; 38: 1 – 9.

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