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Assessment of health status and safety measures among workers in garment industry, Egypt

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Abstract
Background: Garment workers face several ergonomic stressors due to poor physical work environment.
Objectives: the aim of this study was to assess the health status of workers and the applied safety measures in the garment industry.
Subjects and Methods: This comparative cross-sectional study was conducted at Miser Spinning and Weaving Company (MSWC) in El Mahala El Kobra City, Gharbyia Governorate, Egypt. The study included 350 female garment workers and an equal number of 350 administrative female workers as comparative group. An interview questionnaire was filled to collect required data. The latest edition of the Occupational Safety and Health Inspection Checklist (2016) was used and filled by the researcher to check safety measures available and applied in the workplace environment.
Results: The mean age of exposed workers was 41.8+6.65 years with a mean duration of work of 20.80±10.368. More than half of exposed (58.6%) were sewing machine operators. Most of exposed workers (83.5%) suffered from musculoskeletal disorders compared to 60.9% of non-exposed workers, while 72.9% of exposed workers suffered from occular disorders compared to 54.9% of non exposed workers. Environmental measurements in the workplace revealed that noise measurements were within the permissible levels with a mean of 70.9±10.4 and 76.3±8.9 dB in factory 1 and 2 respectively. Light measurements were with a mean of 328.25±152.8 lux and 466.5±303.9 lux in factory 1 and 2 respectively.
Conclusion: The most frequent health problems among garment workers were musculoskeletal disorders and occular problems.
Recommendations: Periodic ergonomic risk assessment of the workplace. Periodic health education and training of workers about ergonomic issues related to their work.

Keywords: Garment industry, risk assessment, ergonomics, musculoskeletal disorders

Introduction

Occupational health aims to promote and maintain highest degree of physical, mental and social well-being of workers in all occupations.

One of the declared objectives of occupational health is to provide a safe occupational environment in order to safeguard the health of the workers and to step up industrial production [1].

The ready-made garment industry which is a total production process constitutes several discrete stages of activities, linked in a progressive manner to form a chain of production process [2]. Within each department, there are a number of steps through which raw materials are passed to make a finished and packed garment. These steps or sub-processes may vary according to the model of the end product. Garment industry comprises; clothes designing, cutting services, sewing, ironing and packing [3]. In this industry, the major risks could be physical condition of the work place or the physical demands of a particular job. This type of occupational hazard is termed an ergonomic hazard [4].

In a systematic review conducted in south and Southeast Asian regions garment workers are vulnerable to several health challenges which include both physical and psychological issues. The physical health issues are produced broadly from the nature of the work they undertake in their employment, including the unhygienic and unsafe working environments, hazardous conditions of the factories, and lack/unavailability of safety measures.

In addition, garment workers are vulnerable to psychological vulnerabilities due to excessive workload, job dissatisfaction, limited job control and low social support, low wages, job insecurity, and feeling unsafe in the workplace [5].

Musculoskeletal disorders (MSDs) are the most common health problems among garment workers as the majority of these workers complained of musculoskeletal problems. As work at a garment production unit represents a complex multifaceted physical work environment, with interactions among the various dimensions of work place, rapid rate of production and sewing machine operators typically sit with sharp forward flexed torso. Other health problems included neural problem such as headache, respiratory problems, skin problems, numbness of hands and fingers, hearing impairment and visual discomfort [6, 7].

On the light of sustainable development strategy Egypt's vision 2030, it could be expected that garment industry will be increased, Attention must be paid to occupational safety and health and providing a working environment with minimal occupational hazards. Therefore, the present study was carried-out at the largest Egyptian garment public sector of Miser Spinning and Weaving Company in El Mahala El Kobra, Gharbyia Governorate, Egypt.

Subjects and Methods

Study design, setting and time

This comparative cross-sectional study was carried-out at Miser Spinning and Weaving Company (MSWC) in El Mahala El Kobra City, Gharbyia Governorate, Egypt.

Study population

Out of the eight garment factories two factories were selected by lottery technique. The number of workers in the selected factories was appropriate for our sample size after taking their consent to participate in the study after application of exclusion criteria.

The sample size was calculated using Epi-Info 7, Software Statistical Package created by World Health Organization and Center for Disease Control and Prevention, Atlanta, Georgia, USA version 2007.

The sample size was calculated as follows

- Confidence interval (CI) of 95%,
- The prevalence of musculoskeletal disorders among garment workers is expected to be 48.5% with a margin of error of 5%. [8]
- Study design effect =1
- Power of the study =80%

The calculated minimal sample size was 320 workers and increased to 350 to overcome any missed data. from the administration sector 350 female were fulfilled our inclusion criteria and were selected as comparative group by convenient sampling.

Exclusion Criteria

1. Workers with background diseases before employment such as respiratory problems and musculoskeletal or rheumatic disorders.
2. Workers who spent less than one year at work.

Tools of study and data collection

Data were collected through an interview with each studied worker using the following tool:

An interview questionnaire which included the following:

- **Personal data:** as age, sex, marital status, residence, level of education etc
- **Detailed occupational history:** which included occupational history as duration of employment, nature of work task, extra work, training at the start of work, training on issues of ergonomics and availability and use of personal protective equipment.
- **Present medical history relevant to**
- Musculoskeletal, respiratory, visual and auditory manifestations.

Statistical analysis and data management

- The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 20, SPSS Inc. Chicago, (IL, USA
- Descriptive statistics were used for all of the categorical variables (presented as frequencies and percentages, mean standard deviation (SD) was done).
- Chi-squared test ($\chi 2$): was used to study the association between two qualitative variables.
- Significance was adopted at $P \leq 0.05$ for interpretation of results of tests of significance.

Administrative design: An official letters were obtained from the dean of Tanta Faculty of Medicine. One of them was directed to the manager of Miser Spinning and Weaving Company (MSWC) in El Mahala El Kobra City to acquaint them about the objectives of the study to get their approval and cooperation for data collection.

The other letter was directed to the Central Agency of puplic Mobilization and Statistics for their approval on conducting this study.

Ethical consideration

Approval code for the research was obtained from the Ethical Committee of Tanta Faculty of Medicine before starting the study with number 33969/7/20. Subjects were informed about the purpose and procedure of the study and benefits of sharing in it to get their approval. Formal written consent from each subject was taken, participation was optional. Data was not used for any purpose other than the scientific research.

Results

Table 1: Distribution of studied workers according to Socio-demographic characteristics

Socio-demographic characteristics		Exposed workers (No.=350)		Non exposed workers (No.=350)		Significance	
		No	%	No	%		P value
Age	<30	22	6.3	20	5.7	χ^2 0.361	>0.05
	30-	146	41.7	142	40.6		
	40-	124	35.4	125	35.7		
	≥50	58	16.6	63	18.0		
	Mean ± SD	41.8±6.65		41.61±7.354		t =41.56	>0.05
Residence	Rural	164	46.9	169	48.3	χ^2 0.143	>0.05
	Urban	186	53.1	181	51.7		
Educational level	Illiterate	8	2.3	5	1.4	χ^2 2.943	>0.05
	Literate	24	6.9	21	6		
	Basic education	122	34.9	107	30.6		
	Secondary and high	196	56.0	217	62		
Marital status	Married	317	90.6	326	93.1	χ^2 6.611	>0.05
	Single	12	3.4	13	3.7		
	Divorced	6	1.7	7	2.0		
	Widow	15	4.3	4	1.1		

Table (1) shows that more than two thirds of the exposed and non-exposed workers belonged to the age categories 30- and 40- years with a mean age of 41.8±6.65 years among exposed workers compared to 41.61±7.354 among non exposed workers. No significant difference was observed between exposed and non-exposed workers regarding age. (p>0.05).

The table reveals also that no significant differences did occur between exposed and non-exposed workers regarding residence, educational level and marital status. (p>0.05)

Table 2: Distribution of studied workers according to occupational history

Occupational history		Exposed workers (No.=350)		Non exposed workers (No.=350)		Significance	
		No	%	No	%	P value	
Work duration	<10	60	17.1	67	19.1	χ^2 0.850	>0.05
	10-	171	38.9	173	49.4		
	20-	94	26.9	85	24.3		
	≥30	25	7.1	26	7.1		
	Mean ± SD	20.80±10.368		18.38±9.396		t= 0.308	>0.05
Extra work	*Yes*	42	12	30	8.6	χ^2 2.223	>0.05
	No	308	88	320	91.4		

Table (2) shows that more than two thirds of exposed workers worked for 10-and 20- years with a duration of work was 20.80±10.368 compared to 18.38±9.396 among non exposed group. No significant difference was observed between both groups regarding work duration (p>0.05). The table reveals also that no significant difference did occur between exposed and non-exposed regarding extra work.

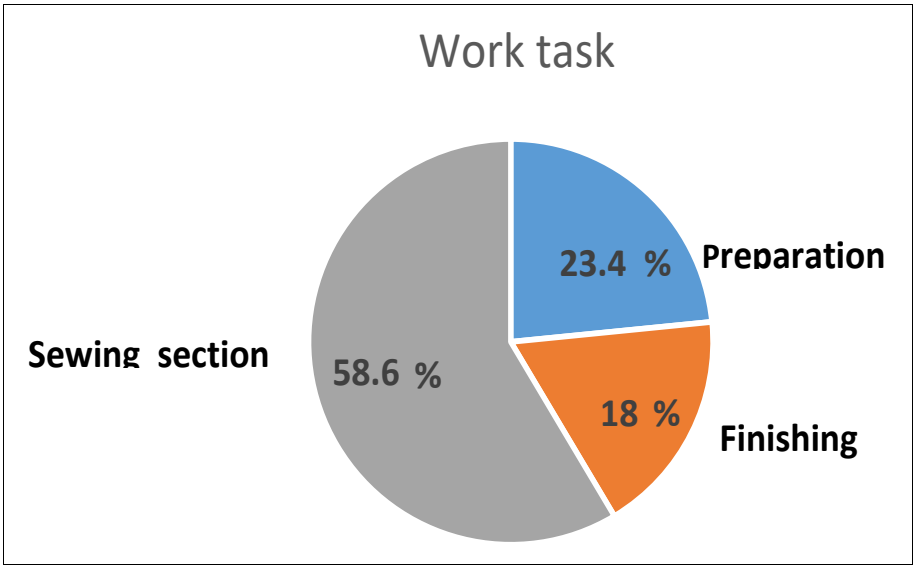

Fig 1: Distribution of exposed workers according to the work task

Figure (1) shows that more than half of exposed workers (58.6%) worked in sewing section, nearly a quarter (23.4%) worked in preparation section, the remaining (18%) worked in finishing section.

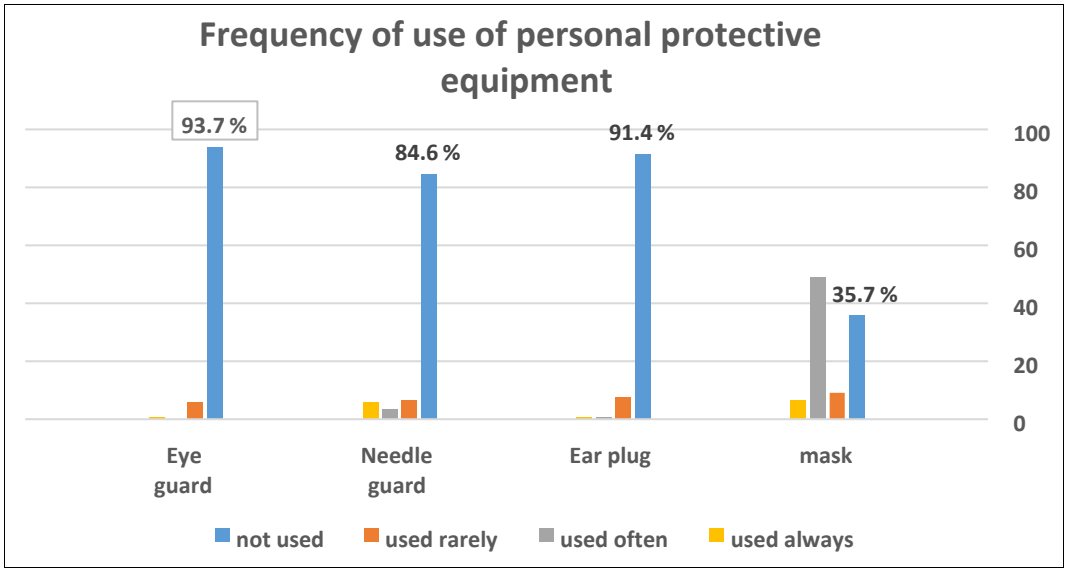

Fig 2: Distribution of exposed workers according to the frequency of use of diffrent personal protective equipment

Figure (2) shows that most of the exposed workers didn't use personal protective equipment.

Table 3: Condition of physical work environment of studied workers

Physical work environment	Exposed workers (No.=350)		Non exposed workers (No.=350)		Significance	
	No	%	No	%	$\chi 2$	P value
Exposure to vibration from sewing machine *and cutting tools*	288	82.3	35	10	367.95	<0.05
Overcrowding of work area	233	66.6	244	69.7	.796	>0.05
Noise pollution	217	62	110	31.4	65.706	<0.05
Presence of fibers dust	200	57.1	157	21.1	10.57	<0.05
There're no Floor mats (antifatigue)	92	26.3	215	61.4	87.776	<0.05
Inadequate light for task	75	21.4	37	10.6	15.349	<0.05
There's no safe drinking water	52	14.9	112	32.0	28.668	>0.05
Bad housekeeping	48	13.7	48	13.7	.000	>0.05
Inadequate air ventilation	48	13.7	65	18.6	3.050	<0.05

Table (3) shows that most of exposed workers (82.3%) exposed to vibration from sewing and cutting tools. The majority of exposed workers (62%) complained of noise pollution, overcrowding in workplace (66.6%), problem with safe drinking water (14.9%), inadequate light (21.4%), inadequate ventilation and dirty workplace (13.7%).

There was a significant difference between the physical work environment of exposed and non-exposed workers regarding; inadequate light and ventilation, noise pollution, exposure to vibration, presence of dust fibers and no floor mats (p<0.05)

Table 4: Distribution of health problems among studied workers

Health problems	Exposed workers (No.=350)		Non exposed workers (No.=350)		Significance	
	No	%	No	%	$\chi 2$	P value
Musculoskeletal disorders	293	83.5	213	60.9	45.64	<0.05
Occular disorders	255	72.9	192	54.9	24.56	<0.05
Respiratory disorders	161	46	157	44.9	0.092	>0.05
Auditory disorders	112	32	95	27.1	1.982	>0.05

Table (4) shows that most of exposed workers (83.5%) suffered from musculoskeletal disorders, and occular disorders (72.9%) compared to non-exposed workers (60.9% and 54.9%) respectively. There was a significant difference between both groups regarding musculoskeletal and occular disorders. (p<0.05)

Table 5: Distribution of exposed workers in different age groups according to prevalence of health problems

Age groups (in years)		Health problems							
		Musculoskeletal		Respiratory		Auditory		Occular	
		No	%	No	%	No	%	No	%
<30 (n=22)		0	0	8	36.3	4	18.2	5	22.7
30 - (n=146)		123	84.2	61	41.8	40	32.5	103	70.5
40 - (n=124)		112	90.3	51	41.1	48	38.7	91	73.3
≥ 50 (n=58)		58	100	37	63.7	20	34.4	56	96.6
Significance	$\chi 2$	128.7		10.31		6.08		44.8	
	P value	<0.05		<0.05		>0.05		<0.05	

Table (5) shows that prevalence of health problems increased with age. The exposed workers in different age group suffered from musculoskeletal disorders except workers who were less than 30 years no one had musculoskeletal disorders. All workers aged 50 years suffered musculoskeletal disorders, followed by workers who were from 40-50 years (90.3%). A significant association was found between exposed workers in different age groups regarding musculoskeletal disorders, respiratory manifestations and occular manifestation $p<0.05$.

Table 6: Distribution of exposed workers in different work duration groups according to prevalence of health problems

Work duration (In years)		Health problem							
		Musculoskeletal		Respiratory		Auditory		Occular	
		No	%	No	%	No	%	No	%
< 10 (n=60)		41	68.3	19	31.7	9	15	33	55
10 - (n=171)		143	83	74	43.3	61	35.7	12	70.2
20 - (n=94)		85	90.4	47	38.9	29	30.8	77	81.9
≥ 30 (n=25)		25	100	18	73	13	52	25	100
Significance	$\chi 2$	18.44		12.4		13.68		23.51	
	P value	<0.05		<0.05		<0.05		<0.05	

Table (6) shows that the prevalence of health problems increased with increasing work duration. All workers who worked more than 30 years (100%) suffered from musculoskeletal disorders, followed by workers who worked for 11 -20 years (94%). The least frequency of musculoskeletal disorders was among workers who worked less than 10 years. Significant association was found between work duration and health problems $p<0.05$.

Table 7: Distribution of respiratory manifestations among exposed and non-exposed workers

Respiratory manifestations	Exposed workers (No.=350)		Non exposed workers (No.=350)		Significance	
	No	%	No	%	$\chi 2$	P value
Rhinitis	98	28.0	112	32.0	1.333	>0.05
Cough	83	23.7	27	7.7	33.824	<0.05
Expectoration	82	23.4	34	9.7	23.803	<0.05
Asthma	76	21.7	35	10.3	17.007	<0.05
Wheezes	35	10.0	11	3.1	13.402	<0.05
Dyspnea	26	7.4	30	8.6	0.311	>0.05
Chronic bronchitis	22	6.3	18	5.1	0.424	>0.05

Table (7) shows that the prevalence of respiratory manifestations among exposed workers was as follow in descending order, rhinitis (28%), cough (23.7%), expectoration (23.4%), asthma (21.7%) and wheezes (10%).There was a significant difference between exposed and non-exposed workers regarding cough, expectoration, wheezes and asthma. ($p<0.05$)

Table 8: Distribution of auditory and occular manifestation among exposed and non-exposed workers

Auditory and occular manifestations	Exposed workers (No.=350)			Non exposed workers (No.=350)		Significance	
	No		%	No	%	$\chi 2$	P value
Auditory manifestations	Vertigo	56	16.0	52	14.9	0.175	>0.05
	Hearing impairment	50	14.3	32	8.5	4.475	<0.05
	Tinnitus	40	11.4	22	6.3	5.734	<0.05
	Ear pain	30	8.6	15	4.3	5.344	<0.05
	Wear a hearing aid	8	2.3	12	3.4	0.824	>0.05
Occular manifestation	Visual impairment	172	49.1	146	41.7	3.895	<0.05
	Burning of eye	137	39.1	120	34.3	1.777	>0.05
	Dryness of the eye	128	36.6	76	21.7	18.707	<0.05
	Itching eye	98	28.0	94	26.9	0.115	>0.05
	Eye pain	74	21.1	88	25.1	1.574	>0.05
	Red eye	66	18.9	56	16.0	0.993	*>0.05*

Table (8) shows that there was a significant difference between exposed and non-exposed workers regarding hearing impairment, tinnitus, ear pain, visual impairment and dryness (p<0.05).

Table 9: Distribution of studied workers according to some psychosocial factors in work environment

Psychosocial factors	Exposed workers (No.=350)		Non exposed workers (No.=350)		Significance	
	No	%	No	%	$\chi 2$	P value
Job is demanding (high work pressure	303	88	278	79.4	9.431	<0.05
Sufficient support from colleagues and supervisors	305	87.1	322	92	6.826	<0.05
Job satisfaction	299	85.4	328	93.7	12.862	<0.05
Job security	270	77.1	318	90.9	24.49	<0.05
Authority to control my work	227	64.9	259	74	6.892	<0.05

Table (9) shows that the positive aspect of psychological factors were more frequent among non exposed workers with statistical significant difference between exposed and non exposed groups (p<0.05).

Table 10: Assessment of work station by exposed workers

Work Station	Number (n=350) yes	%
The area for legs and feet free from impeding fixtures	301	86
The work space permit a stable neutral posture and ease of movement in work space	70	20
There is enough leg and foot space available while sitting and standing	287	82
Sufficient space for routine work activities	80	22.9
The work surface area is appropriate for visual and manual requirements	150	42.9
The Chair adjustable and has a good stability	141	40.3
The work table is titled and adjusted in height (to improve the visibility of the work area)	170	48.6
The chair has a back rest	162	46.3
The working table edges are rounded	146	41.7
The seat pan adequately cushioned	121	34.6
Using foot rest, arm rest, or lumbar pads while working	131	37.4

Table (10) shows that only 22.9% of the exposed workers were satisfied with the presence of sufficient space for routine work activities while most of workers (82%) were satisfied with the enough leg and foot space available while sitting and standing. Only 46.3% of the workers have chairs with a back rest. Tables with rounded edges were available to 41.7%.

Table 11: Environmental measurements in the work place of the exposed workers

Environmental measurements		Measurement points in factory 1		Measurement points in factory 2	
		No	%	No	%
Noise level (dB)	Mean ± SD range	10.4±70.9 59-87		76.3±8.9 68-89	
Light intensity (Lux)	Mean ± SD Range	328.25±152.8 126-580		466.5±303.9 221-985	

Table (11) shows environmental measurements in the workplace of the exposed workers. According to environmental measurements records in 2022 in garment sectors and the Egyptian work law;

- Noise level was with a mean of 70.9±10.4 and 76.3±8.9 dB in factory 1 and 2 respectively.
- Light intensity was with a mean of 328.25±152.8 lux and 466.5±303.9 lux in factory 1 and 2 respectively.

Discussion

Our study revealed that more than two thirds of the exposed and non exposed workers (41.7%, 40.6% respectively) belonged to the age categories 30- and 40- years. with a mean age of 41.8+6.65 years in exposed workers compared to 41.61±7.354 in non exposed workers. No significant difference was observed between exposed and non-exposed workers regarding age. (p>0.05).

Our results were supported by study of occupational hazards at garment factory in Damietta ciry by Ibrahim, 2017 [10] as he reported that the age of the study group ranged from 18-60 years with a mean age 39.07±12.63 years and two-fifths (40.0%) of them were between the ages of 46-60 years. The mean age of participants was lower than our result. This disagreement could be explained by different sample size and sampling technique between the two studies.

In contrast to our result, a study among garment workers in Bangladesh conducted by Fitch *et al*., 2017 [11] revealed that garment workers tended to be little younger with amean age of 27.8 years compared to the non-garment group. The comparison group were more likely to have no education (46.6% with no schooling vs 38.3%). It appears that garment workers were relatively younger and had higher education with more stable marital relationship. This may be due to different cultures related to social and economic issues.

In our study regarding the exposed workers, most workers (90.6%) were married. Majority of workers (53.1%) were from urban areas and had secondary and high level of education (56%). All the exposed and non exposed workers were female (100%) (as shown in table 1). This was agree to

most of the studies in garment factories which revealed the dominance of female workers. We may predict that the female workers are satisfied with fewer wages and they are less demanding but they work sincerely. Parimalam *et al*., 2007 [12] calculate the percentage of male and female workers in different sections of garment factories. In cutting section it was almost equal but in stitching and finishing section female were more, about 67% and 57% respectively.

In the present study (as shown in figure 1) more than half of exposed workers were sewing machine operators (58.6%), nearly quarter (23.4%) worked in preparation section and the remaining (18%) in finishing section.

In accordance with our results, another cross sectional study among garment workers in Bangladesh conducted by Gupta *et al*., 2015 [13] revealed that 52.4% of the respondents worked as machine operator, followed by (28.3%) worked as helper and the least (1.4%) of the respondents worked as lineman, while in a study of ergonomic risk assessment in textile industry by Comper & Padula, 2013 [14] revealed that 48.5% were sewing machine operators and 51.4% worked in finishing sections.

In the study in our (as shown in figure 2), most of the exposed workers didn't use personal protective equipment. It was found that only 22 workers (6.3%) always use masks. Two workers (.6%) always use ear plugs and 320 workers (91.4%) do not use it at all during work. Only twenty workers (5.7%) use needle guard and two of them (.6%) use eye guard. About rubber mat two workers (.6%) sometimes use it

Our result was supported by Islam *et al*., 2014 who found that only 15.7% of the workers in the garment factories were using masks. [15]. Also, Ibrahim, 2017 [10] revealed that 74.1% of the overall uniform were unavailable, 84.3% of the study group did not use head cover and 24.1% of them were using the protective apron.

In the current study most of exposed workers (82.3%) complained of vibration from sewing and cutting tools. The majority of exposed workers (62%) complained of noise pollution this might be due to, many sewing machines operate at once. Therefore, the noise is at a high level.

About two third (66.6%) complained of overcrowding in workplace this might be due to, In the cutting sections, distance between the tables are very narrow. Therefore, the workers face difficulties to move around and to carry the fabric rolls and cutting materials. In the sewing sections, mostly there were two employees for one machine. If one employee sew, other employee will be the helper to collect the materials. Therefore, there were lots of employees and available space is not adequate for circulation.

Other problems were absence of safe drinking water (14.9%), inadequate light (21.4%), and inadequate ventilation (13.7%) as in the sewing sections, many assembly lines and large number of employees are working. Due to the crowd, proper ventilation is not there.

In addition to that 9% complained of dirty workplace. There was a significant difference between exposed and non-exposed workers regarding; inadequate light and ventilation, noise pollution, exposure to vibration, presence of dust fibers and no floor mats (P=<0.05).

Our findings were supported by some studies by Joshi *et al* (2011) [16] in their study found that major causes of occupational hazards were due to long working hour, unsafe working conditions, lack of supervision and training, use of old machinery and equipment, overcrowded production unit with very congested space, working with machines and equipment, use of electricity, use of chemicals in industries and dusty work sites.

Ibrahim, 2017 [10] stated that 76.6% of the study group were exposed to noisy hazard; more than half (55.8%) of them were exposed to extreme temperature, while those who exposed to vibration and electrical shock were 32.5% and 20.8% respectively. Moreover, Gupta *et al*., 2015 [13] revealed that 44.1% of respondents had no problem with their physical environment. Approximately one third (33.8%) complained of noise pollution, overcrowding in workplace (13.8%), problem with safe drinking water (15.9%), inadequate light (9.7%) and inadequate ventilation (4.1%), dirty workplace (9%), no separate toilet facilities (5.5%)

Jahan *et al*., 2015 [17] in her study among 5 garment factories. Only one factory was overcrowded, congested, poorly ventilated and workers also complained noise pollution. All the factories were devoid of adequate toilets and safe drinking water.

In this study, the frequency of respiratory manifestations in exposed workers was as follow in descending order, rhinitis (28%), cough (23.7%), expectoration (23.4%),asthma (21.7%) and wheezes (10%).There was significant difference between exposed and non exposed workers regarding respiratory manifestations such cough, expectoration, wheezes and asthma. (P=<0.005).

Exposed workers suffered more frequently from respiratory problem as they engaged with the fabrics stitching in the factory and they continuously inhale the fabric dust causing respiratory health problem. [18].

Similarly, Fitch *et al*., 2017 [11] revealed that garment workers reported higher prevalence of asthma.

Our results showed that the most prevalent occular manifestations in the exposed workers was visual impairment (49.1%) compared to 41.7% in the non exposed group, followed by eye burning (39.1%) then eye dryness (36.6%). There was a significant difference between exposed and non exposed workers regarding visual impairment, dryness, hearing impairment, tinnitus and ear pain (p<0.005).

The exposed workers face strain on their eyes as they work for long time and need a keen concentration to their work, an extra pressure is created on their eyes which affect on the visual comfort.

Our results were supported by a study assessed the health status of female workers in the garment sector of Bangladesh, the factory was unhygienic and noisy and therefore, the majority of the workers suffer from a lot of health proplems like hearing problem, asthma and eye problems [18]. However, in the study of Fitch *et al*., 2017 [11], garment workers reported lower prevalence of vision problem.

The current study showed that most of exposed workers (83.5%) complained of musculoskletal disorders compared to 60.9% among non-exposed workers. This finding was comparable with the studies done in Sweden, Denmark, Boston, UK and Finland; where the prevalence of musculoskeletal disorders was reported to be from 34 to75% [19–22]. However, a study in the Los Angeles, USA, showed that the prevalence of neck and shoulder was 25% and 16%, respectively [22].

This study showed that the analyzed workstations was not designed in accordance with ergonomic requirements. Only

46.3% of the workers have chairs with a back rest and 37% used foot rest, arm rest, or lumbar pads while working. Tables with rounded edges were available to 41.7%.

The types and magnitude of musculoskeletal disorders greatly depend on the working environment or individual enterprise. One common point to all workstations in the garment process is the stress induced by the forced position of the operator, due to the nature of work, the operator in sewing section is in a sitting position for the whole time. The stress is still greater because workstations are inadequately designed, i. e. Unadapted to the operator's measurements.

The majority of exposed and non-exposed workers had high job pressure (88% and 79.4%) respectively as shown in table 14.

It well recognized that high mental and psychological stress increase muscle tension and decrease micro pauses in muscle activity. This may lead to muscle fatigue, even in cases of low loads due to continuous firing of low threshold motor units, which are triggered not only by low level physical loading but also by mental loading. The central nervous system response to job stress may amplify painful sensations resulting in a higher prevalence of MSDs [23].

Environmental measurements

Our study showed that the mean of light measurements was 328.3±152.8 lux and 466.5±303.9 lux in factory 1 and 2 respectively.

According to Gandotra *et al*. [27]. The lighting between 500 lux and 1000 lux gives satisfaction to workers.

Our measures were similar to another study by Padmini and Venmathi 2012 [28] at thirteen garment factories of large, medium and small scale for the measurement of work environment parameters using concerned apparatus and assessment of safety measures practiced by garment workers which showed that the lighting levels ranged from 176 – 918 lux with a mean of 410 lux.

Both too much or too little light can lead to a reduction in quality and productivity as workers either struggle to see their work or find the glare too much for their eyes.

It was found that the mean of the noise measurements in our study was 70.9±10.4 dB and 76.3±8.9 dB in factory 1 and 2 respectively.

High noise levels are found in some points of garment industries. As the factory contain some machines were likely to produce high noise levels. Similarly, many of the sewing machines are old or mounted incorrectly, they were likely to produce high noise levels.

In Egypt, the current threshold level value for eight hour noise exposure is 85 dB [29].

In another study by Padmini and Venmathi 2012 [28] The noise level ranged from 74 dB to 102 dB with a mean of 91.7 dB so noise level in this garment industries was found to be above the recommended levels.

Conclusion

Workers in garment industry exposed to various types of occupational health hazards at their workplaces which resulted in tremendous harmful effects namely musculoskeletal disorders, occular, respiratory and auditory disorders.

There was obvious shortage and unavailability of personal protective equipments.

Recommendations

Based on the findings of the present study; the following can be recommended:

- Periodic medical examination for early detection and management of health problems.
- Regular periodic environmental monitoring for light, noise, heat, humidity and dust to ensure their values are within the permissible level.
- Education of workers about health problems and hazards at garment industry and periodic training programs on safe work practice.

List of abbreviations

(CI) Confidence interval

(MSDs) musculoskeletal disorders

Declaration

- **Ethical Approval**

This study was approved by Tanta Faculty of Medicine Research Ethics Committee (REC) before starting the study with number 33969/7/20.

- **Consent to Participate**

Formal written consent was taken from all study participants.

- **Consent to Publish**

Not applicable.

- **Authors Contributions**

[AA Conceptualization, methodology, data analysis and writing the original draft. HA reviewed the findings and the original draft. MS revision of the final manuscript for submission. All authors read and approved the final manuscript. S A supervision and direction throughout the research, reviewing methodology, data curation, the original draft and final manuscript for submission.]

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- **Availability of data and materials:** Not available

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