Occupational Exposure to Some Environmental Physical Factors as Related to Productivity in the Garment Industry of Egypt

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Abstract

Background: Garment industry in Egypt has been estimated in 2008 to be about 458 enterprises (employing 103,000 workers) representing 42.0% of the overall textile and garments industries, and 4.8% of the total private sector enterprises. Al-Mahalla Al-Kubra, which is the greatest city of El-Gharbia Governorate houses 263 (57.4%) of these enterprises (employing 12,209 workers). The occupational exposure to physical hazards may adversely affect workers’ comfort, health, performance and productivity.

Objective(s): This study was designed to assess the relation between work stresses imposed by exposure to physical hazards and productivity in Garment industry in that city.

Methods: This was a cross-sectional study that was conducted in five garment enterprises in Al-Mahalla Al-Kobra city. The five enterprises included two public and three private sector units, representing 12% of the total number of garments’ workers within the city. The collected data included data from records, workers’ and employers’ or managers’ interview, and the results of the physical hazards’ assessments. Since it was difficult to calculate the workers’ productivities directly from enterprises’ records, the productivities of the workers were computed as follows: % of productivity = Standard workers’ productivity (100%) - % deficiency in his or her productivity from the standard.

Results: The higher percent productivity reported in the Private sector enterprises (86.5%, 86.5% and 100% in C, D, and E enterprises respectively) than in the Public (71.5% and 54.7% in A and B enterprises respectively) may be attributed to the production payment regimen common in the former than in the latter. The workers in the Private-sector enterprises were keen to achieve the greatest production to get maximum payment. This may also interpret the considerably higher workers’ attendance (less absenteeism) among Private-sector workers than in the Public-sector ones.

Conclusions: The deleterious effects of workers’ exposure to physical hazards; heat, noise and vibration, and improper illumination on their productivity are clearly demonstrated in the present study. Attention should be directed towards the control of these hazards and improving the work environment of the garment industry in Egypt, particularly in the Public sector enterprises.

Key Words: Ready Made Garment Industry, Productivity, Physical Hazards, Al-Mahalla Al-Kubra, Egypt

INTRODUCTION

The ready-made garment industry is a total production process constitutes several discrete stages of activities, which are linked in a progressive manner forming a chain of labor intensive production process. 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. Most common steps in each department of the apparel industry include: cutting, sewing, and finishing. The garment industry is at the forefront of the globalization process, where multinational investors continuously shift production from one part of the world to another searching for low wages and even more “competitive” locations. This has led to an increase in working hours and a substantial reduction in safety standards, especially in the newly industrialized countries. The economic
viability of this sector largely depends on the performance of the workers. Consequently, it has been necessary to maintain an excellent work environment for maximizing productivity. However, many work stresses are facing most workers in the garment industry due to poor working environment.

The garment industry comprises a large number of small units, spread all over Egypt. Each industrial unit has as few as five sewing machines to as many as 1,000 to 1,200 machines. It is estimated that about 458 units are operating in the country, representing 42.0% of whole textile and garments units and 4.8% of the total private sector unit, in 2008. The overall workforce employed within the garment industry is about 103,000 workers, representing 56.6% of total textile and garments' workforce, and 12.7% of total private sector workforce; women represent the major work force. The annual industrial production of was estimated to be around 330.1 million pieces in 2009/2010 versus 269.2 million pieces in 2007/2008 by an increase of 22.6%. These figures, however, do not include machine operators of the countless number of small tailoring shops at every hook and corner of the country.

Al-Mahalla Al-Kubra is a large industrial and agricultural city in Egypt, representing the greatest city of El-Gharbia Governorate and the second-largest city in the Nile Delta. It has been known for its dominant textile industry as it homes the largest public sector Egyptian Textile Company “Misr Spinning and Weaving Company,” which employs 27,000 workers. Meanwhile, Al-Mahalla Al-Kubra garment industries represent 17.4% of the total garment industry in Egypt (n=1510), and employing 11.9% of the workers in this industry in the country (n=103000).

The physical hazards such as noise, heat, vibration and deficient lighting adversely affect workers’ comfort, health, performance and productivity. A comfortable working environment reduces accidents and associated costs. Meanwhile, it increases the productivity through enhancing workplace safety awareness, improving work satisfaction and workers’ performance. In addition, workers understand that the employer cares about their safety; and then, they become more motivated.

Productivity is a measure of how well a manufacturing unit uses its resources measured as units of output per unit of input. Output includes all the goods, and services produced and sold. Input includes all the materials, services, machinery usage, and efforts expended in the production of the outputs. A production unit can be defined at any level of aggregation desired: a single facility within a multi-facility organization, an entire firm, a whole industry, a sector of the economy, a country, or a region. In practice, there are many different ways to measure productivity. Each measure has its benefits and drawbacks.

The European Union Community strategy (2007-2012), points that guaranteeing quality and productivity at work can play a role in promoting economic growth and employment. This is because of the lack of effective protection can result in absenteeism and increase of workplace accidents and illnesses that can lead to permanent occupational disability. This does not only have a considerable human dimension, but also has a major negative impact on the economy. This statement is derived from the European Union strategy that confirms the interaction between health and safety at work on the one hand, and on the other hand, reduction of productivity. Besides, European Association for National Productivity Centers issued a memorandum in 2005, looking upon productivity from the perspective of value creation, stressing that several factors contribute to this value creation. Health and safety at work are some of these factors. This is why companies increasingly need qualified, motivated and efficient workers who are able and willing to contribute actively. Healthy workers working in healthy working conditions are thus an important precondition for the enterprise to work smoothly and productively.

This study was designed to investigate the relation between work stress introduced by physical hazards, viz heat, noise, vibration and deficient illumination in the work environment, and productivity, in the garment industry in Al-Mahalla Al-Kobra, as an example of the garment industry of Egypt.

METHODS

The present study is a cross-sectional study. It was conducted in five garment enterprises in Al-Mahalla Al-Kobra city. The five enterprises are denoted by the symbols A to E, where the A and B enterprises belong to the public sector, while the C, D and E enterprises belong to the private sector. The selected sample represents 12% of the total number of garments' workers in Al-Mahalla Al-Kobra city. The enterprises employ less than 10 workers were excluded. The collected data comprised:

- Measurement of the physical environmental factors, mainly heat, noise, vibration and illumination in different locations in the work environments of the studied enterprises.
- Workers' interview for their demographic data and for their job and industrial relation satisfaction.
- Interview of the employers / managers for their satisfaction with the workers.
- Examining the enterprises' records for workers' production, and absenteeism.

Illumination was measured according to the standard specification for testing British Standard [19] using Lux meter (YF-1065; Taiwan). [20] The workers and the employers/managers were interviewed using pre-designed and pretested forms developed according to the US labor Department of OSHA guidelines. [21] Due to the difficulty in calculating productivity of the workers directly from enterprises' records, data of the percentage deficiency from the required standard productivity for each worker during a certain period of the year (viz; week, month, or month) were collected, and then the percent of productivity was calculated as follows: % productivity = 100% - % Deficiency. [22]

Ethical Considerations
The study was approved by the institutional review board and the ethics committee. The study conformed to the principles of Helsinki declaration and the international ethics guidelines. A verbal consent was taken from all participants after explanation of the purpose and benefits of the study. Confidentiality of the data was assured.

RESULTS

1-Levels of Occupational Exposure to Physical Factors in the Studied Enterprises
Table (1) presents the measurements of environmental physical factors in the studied enterprises. The levels of exposure to heat and noise were lower than the Threshold Limit Values (TLVs). [23] Meanwhile, the heat exposure is relatively high in the B and C enterprises (24.2ºC and 23.2ºC respectively). The noise exposure was greater in the Public sector enterprise B (83.5 dBA) than in the private. Worthy, noting that the environmental measurements were conducted in fall, winter and spring climatic seasons. However, exposure to vibration exceeded the TLVs in A and D enterprises (4.1 and 4.6 m/sec² respectively), and unfavorable levels of illumination were predominant in all the enterprises; meanwhile, the levels of illumination in the Private sector were better than those in the Public sector enterprises.

2-Demographic and Occupational Data of the Workers
According to the enterprises' records, the total number of the workers is 1510 (table 2), out of which 1180 work by production regimen. The five enterprises apply one shift system; the shift in the public sector enterprises (A and B) consists of 8 hours, while that in the private sector ones (C, D and E) are 10 hours. Over-time hours are normally applied whenever it is needed. The starts of practicing production activities in the public sector enterprises (A and B) were in the years 1979 and 1989 respectively, which were relatively older than that in the Private sector enterprises (C, D and E) in the year 1985, 2003, and 2000 respectively. Enterprises of the Public sector consist of one floor; while the work force in the Private sector’ enterprises perform their activities at different floors. The countries of manufacture of the tools and equipment as scissors, sewing machine…etc. in the Public sector enterprises are USA Germany, Italy and France, produced through the years of 1980s until 2000. While that in the Private sector are USA, European countries, in addition to South - East Asian countries such as Japan, Taiwan and Korea, which have been more recently produced and range from the years 2000s until 2011.

The workers' demographic data in the studied enterprises are presented in table (2) demonstrating that male children labor (< 20 years aged) was dominant in the Private rather than Public sector enterprises. At the same time, the females were the most common in the Public sector enterprises A, and B (89.3 and 77.4 respectively) and in the two Private D, and E (63.3% and 62.0% respectively). The highest prevalent age group was (31-40) years old, existing in the Public sector (34.6% and 47.0% in enterprises A and B respectively). The workers aged more than 30 years, represent 87.0% and 77.0% in A, and B Public enterprises, while this age category of workers expresses just 5.0% in the enterprise C, 41.0% and 28.0% in enterprises D and E respectively of the Private sector. Mostly, one-third of the workers were illiterate in the studied enterprises, except for enterprise B, in which the illiterate workers represent 24.2%. Most of the married workers were in the Public sector representing 53.0%, while most of the single workers were in the Private sector representing 66.0% of the workers there. The majority of workers have a family size of (1-5) representing 49.5%; however, still large families (6-12 persons) represent more than one-half of the population (50.5%). The occupational data of the studied workers are illustrated in table (3). More than 60% (61.9%) of the workers are involved in sewing and finishing, particularly in the private sector enterprises (72.7%, 63.3% and 62.2% in D, E, and C enterprises respectively.)
### Table 1: Results of Environmental Physical Factors Measurements in the Studied Enterprises

<table>
<thead>
<tr>
<th>Physical Factor</th>
<th>Public sector group</th>
<th>Private sector group</th>
<th>TLV#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Range</td>
<td>Median</td>
<td>Range</td>
<td>Median</td>
</tr>
<tr>
<td>Heat WBGT : °C</td>
<td>20.2-22.0</td>
<td>21.1</td>
<td>24.2</td>
</tr>
<tr>
<td>(n^3=6)</td>
<td>(n^3=8)</td>
<td>(n^3=6)</td>
<td>(n^3=8)</td>
</tr>
<tr>
<td>Noise: dBA</td>
<td>68.0-86.3</td>
<td>79.4</td>
<td>67.0-88.0</td>
</tr>
<tr>
<td>(n^3=6)</td>
<td>(n^3=8)</td>
<td>(n^3=6)</td>
<td>(n^3=8)</td>
</tr>
<tr>
<td>Vibration m / sec.²</td>
<td>2.2-5.0</td>
<td>4.1</td>
<td>0.2-5.0</td>
</tr>
<tr>
<td>(n^3=6)</td>
<td>(n^3=8)</td>
<td>(n^3=6)</td>
<td>(n^3=8)</td>
</tr>
<tr>
<td>(n^3=6)</td>
<td>(n^3=8)</td>
<td>(n^3=6)</td>
<td>(n^3=8)</td>
</tr>
</tbody>
</table>

n^3: number of measurements through study period

#ACGIH: American Conference of Governmental Industrial Hygienists Threshold Limit Values

*For moderate physical activity dominant in garment industry (75 – 100%) work.

**For 4 up to < 8hrs / shift.

***For precise type of work dominant in garment industry.
This was followed with the great differences, by "ironing" (13.8), "supervision" (8.4%), and "testing and packing" (8.8%). More than one-half of the workers in the Private sector (53.4%) have limited experience (0-5 years) particularly in enterprise C (75.0%), while this sector represents only 6.2% of the workers in the Public sector. The workers employed for over 10 years are 71.7% in the Public sector and just 17.1% in the Private sector. Furthermore, none of the workers in the Private sector were employed over 30 years. The average monthly payment for the Public sector's workers in the enterprises is 1741.3 LE, while that of the worker in the Private sector was 758.6 LE. Meanwhile, mostly 80% (79.1%) of the Private-sector workers' monthly payments range from 500 to 1000 LE. This workers' sector in the Public enterprises was just 4.7%; 62.5% of the workers, there get monthly payments ranging from 1500 to 3000 LE, while none of the workers in the Private sector get such payment. Mostly, 80% (79.1%) of the Private-sector workers' monthly payments range from 500 to 1000 LE. This workers' sector in the Public enterprises was just 4.7%; and 62.5% of the workers there get monthly payments ranging from 1500 to 3000 LE, while none of the workers in the Private sector get such payment.

3-Productivity, Absenteeism and Satisfaction of the Workers

The lowest number of workers resulted in deficient productivity of the Public sector in enterprises A and B (3.2% and 0.7% respectively); while, the highest number exist in the Private sector, especially in enterprise E (76.0%), as illustrated in (Figure 1). However, the magnitude of the product deficiency in the Public sector enterprises was considerably higher than in the Private sector as shown in table. (4) The percent productivities in the private sector enterprises are 86.5%, 86.4% and 100.0% in C, D, and E enterprises respectively, in comparison to 71.5% and 54.3% in the public sectors' enterprises A and B. Meanwhile; the lowest productivity ranges in the Public sector enterprises (54.3% in enterprise A, and 14.3% in enterprise B) were considerably lower than those in the Private sector enterprises (75.5%, 76.8% and 76.1% in enterprises A, B and C respectively). Besides, there is a statistically significant difference between the percent productivity of the selected enterprises (p<0.001, 95% C.I). The workers' status of absenteeism in the studied enterprises is presented in table 5. All types of absenteeism were considerably higher in the enterprises of the Public sector than in those of the Private sector. For example, the authorized, the non-authorized and the occupational injuries' absences among the workers of the Public sector enterprises were 95.9%, 12.0% and 1.5%, while in the Private sector enterprises, there were 62.7%, 2.2% and 0.6% respectively. Furthermore, the mean days of sickness absence among the workers at the Public sector enterprises were two days, while in the Private-sector enterprises, was just 0.1 day. Meanwhile, the maximum percentage of sick leaves (30-90 days group) was only in Public sector enterprises A and B (5.1% and 4.8% respectively).
Furthermore, the highest percentage of workers, who didn't have any type of absenteeism at all, was found in the C, D and E Private sector enterprises (39.3%, 34.9% and 37.5% respectively). Worth noting that according to enterprises' records, the most frequent disciplinary actions for unauthorized absence were in the public sector in factories A and B (9.0% and 11.5% respectively). The workers' and employer / manager satisfactions are illustrated in figure (2). The highest percentage of workers who are unsatisfied in their job was found in the Public sector enterprises A and B (81.7% and 71.6% respectively). The maximum percent of workers, who were relatively satisfied about their job, was found in Private sector C, D and E enterprises (51.1%, 46.2% and 36.6% respectively). The maximum percent of workers, who are highly satisfied about their employer / manager was found in the Private sector, C, D and E enterprises (80.0%, 70.6% and 63.1% respectively). Whereas, the highest percentage of workers, who are unsatisfied about their employers / managers was found in the Public sector enterprises A and B (71.0% and 79.8% respectively). The maximum percent of highly satisfied employer / manager about his workers was found in factories A, B and C (74.9%, 60.4%, 60.0% respectively), while the lowest percentage was found in factories D and E (58.2% and 59.1% respectively).

Table (3): Occupational Data of Workers in the Studied Enterprises

<table>
<thead>
<tr>
<th>Enterprises</th>
<th>Public sector group</th>
<th>Private sector group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of workers</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Occupational Data</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Job</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting</td>
<td>7</td>
<td>2.5</td>
</tr>
<tr>
<td>Sewing and finishing</td>
<td>160</td>
<td>57.4</td>
</tr>
<tr>
<td>Ironing</td>
<td>51</td>
<td>18.3</td>
</tr>
<tr>
<td>Packing &amp; Testing</td>
<td>28</td>
<td>10</td>
</tr>
<tr>
<td>Supervision</td>
<td>20</td>
<td>7.2</td>
</tr>
<tr>
<td>Assisting production &amp; cleaning</td>
<td>13</td>
<td>4.7</td>
</tr>
<tr>
<td>Duration of Employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>22</td>
<td>7.9</td>
</tr>
<tr>
<td>6-10</td>
<td>22</td>
<td>7.9</td>
</tr>
<tr>
<td>11-20</td>
<td>74</td>
<td>26.5</td>
</tr>
<tr>
<td>21-30</td>
<td>68</td>
<td>24.4</td>
</tr>
<tr>
<td>31-45</td>
<td>93</td>
<td>33.3</td>
</tr>
<tr>
<td>Average monthly payment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-500</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>501-1000</td>
<td>3</td>
<td>1.08</td>
</tr>
<tr>
<td>1001-1500</td>
<td>50</td>
<td>17.92</td>
</tr>
<tr>
<td>1501-2000</td>
<td>92</td>
<td>32.97</td>
</tr>
<tr>
<td>2001-3000</td>
<td>134</td>
<td>48</td>
</tr>
</tbody>
</table>

4-Workers' Productivity and Their Occupational Exposure to Physical Factors

In order to test the effect of workers' exposure to the physical factors on their productivity, the data of all the studied workers were pooled and divided into eight groups according to their occupational exposures, viz; exposed to WBGT < 24°C and to 24+ °C, exposed to noise < 85 dBA and to 85+dBA, exposed to vibration < 5m-2 and to 5+ m-2 and working at levels of illumination < 400 lux and 400+ lux. The median and range of the percent productivity of both groups of each exposure are compared as illustrated in (Figure 3). Lower levels of productivity existed among the group of the workers who are exposed to the higher levels of heat and noise, as well as those working at lower levels of illumination (Figure 3A, 3B, 3D). However, although workers in all the enterprises are exposed to levels of vibration exceeding the threshold limit value (4m/sec²), the levels of workers' productivity decreased as the levels of exposure to vibration increased particularly in the Private sector enterprises (Fig. 3C).

Figure 1: Distribution of Workers of the Selected Enterprises Whose Productivities are within Standard Productivity
Figure 2: Percent Distribution of Workers and Employers/Managers in the Studied Enterprises According to Satisfaction.
Figure 3: The medians and ranges of percent productivity of the workers in the studied enterprises as related to their exposures to different levels the tested physical factors.
Table (4): Percent Productivity in the Studied Enterprises

<table>
<thead>
<tr>
<th>Enterprises</th>
<th>Percent productivity</th>
<th>Kruskal-Wallis Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Median</td>
</tr>
<tr>
<td>A (N= 279)</td>
<td>54.3</td>
<td>100</td>
</tr>
<tr>
<td>B (N= 356)</td>
<td>14.3</td>
<td>100</td>
</tr>
<tr>
<td>C (N= 280)</td>
<td>75.5</td>
<td>100</td>
</tr>
<tr>
<td>D (N= 275)</td>
<td>76.8</td>
<td>100</td>
</tr>
<tr>
<td>E (N= 320)</td>
<td>76.1</td>
<td>100</td>
</tr>
</tbody>
</table>

*N is the number of workers in the enterprise

Table (5): Distribution of Workers of the Selected Enterprises According to Their Different Types of Absenteeism

<table>
<thead>
<tr>
<th>Types of Absenteeism</th>
<th>Public sector (N=279)</th>
<th>Private sector (N=280)</th>
<th>Total (N=1510)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A (N=279)</td>
<td>B (N=356)</td>
<td>C (N=280)</td>
</tr>
<tr>
<td>N</td>
<td>%</td>
<td>N %</td>
<td>N %</td>
</tr>
<tr>
<td>Authorized absence</td>
<td>259</td>
<td>92.8</td>
<td>350</td>
</tr>
<tr>
<td>Unauthorized Absence</td>
<td>25</td>
<td>9</td>
<td>42</td>
</tr>
<tr>
<td>Absence Due to</td>
<td>6</td>
<td>2.1</td>
<td>4</td>
</tr>
<tr>
<td>Occupational Injuries</td>
<td>1-6</td>
<td>12</td>
<td>30.8</td>
</tr>
<tr>
<td>Number of Sick Days</td>
<td>7-14</td>
<td>16</td>
<td>41</td>
</tr>
<tr>
<td>Leave Days</td>
<td>15-29</td>
<td>9</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>30-90</td>
<td>2</td>
<td>5.1</td>
</tr>
</tbody>
</table>

*p<0.0001

DISCUSSION

Although the levels of workers’ exposure to heat in the studied enterprises were mostly lower than the TLV (23) for moderate activity type of work dominant in the garment industry. Since the measurements were conducted during fall, winter, and spring climatic season, yet much higher workers’ exposure levels to heat are anticipated in summer months, climate presenting high stress on them. Meanwhile, the higher margins of the ranges of the exposure levels to noise are very close to the TLV (23) (85 dBA) in the Private sector enterprises, and higher than the TLV in the Public sector enterprises (86.3 dBA and 88.0 dBA in enterprises A and B, respectively). Moreover, unfavorable levels of illumination exist in all the studied enterprises, particularly in the Public sector enterprises. The relatively worse environmental exposure to the tested physical factors in the enterprises of Public sector than in these of the Private sector may be attributed to their older establishment with the rare (or even no) renovations.

Previous studies in the garment industries and others, particularly in developing countries have reported that workers’ exposure to excessive climatic heat, and heat derived from improper lighting systems and lack of proper ventilation, to excessive noise and vibration, and to inappropriate illumination represent more hazards to them. (24-27) For example, both male and female workers have been reported to get injured with a machine needle due to the improper illumination. (24)

As related to workers’ profiles, the data demonstrated that garment industry is a main employer of females (viz: in 84.1% of the studied Public sector and in 50.1% of the Private sector enterprises – table 2). Moreover, the child labors (< 20 year age) were mostly males, in the Private sector enterprises (38.5%), and illiteracy is high among them (30%), (Table 2). Previous studies in developing
countries, representing similar economic condition to
the current conditions in Egypt, reported compliant
findings. A study was conducted in the year 2000
Bangladesh used survey data from the years 1990,
1993 and 1997 to evaluate how the employment of
women in export-oriented industries exploits the
“comparative advantages of their disadvantages.”
According to the study, women constitute about 66
percent of the workforce in the export-oriented
garment industry in Bangladesh. The assembly-line
nature of garment manufacturing is one of the main
reasons for higher employment of women in this
industry.\(^{(28)}\) Also, official estimates suggest more than
12 million child laborers in India (Census 2001).\(^{(29)}\)

The age category of the workers at the Public
sector enterprises (31 - 60 years old: 87.6%) was
higher than at the Private sector. The workers aged 10
- 20 years old represented 74.9%, had its impact on the
proportion of the married, divorced and widowed
workers (viz: 46.1% in Public sector and 35% in
Private sector), as well as their family size (Table 2).

The higher percent productivity reported in the
Private sector enterprises (86.5%, 86.5% and 100% in
C, D, and E respectively) than in the Public sector
enterprises (71.5% and 54.7% in enterprises A and B,
respectively) (Table 4) may be attributed to the
production payment regimen common in the former
than in the latter. The workers in the Private sector
enterprises are keen to achieve the highest production
to get maximum payment. This may also interpret the
considerably higher workers’ attendance (less
absenteeism) among Private-sector workers than in the
Public sector workers (Table 5). In addition, the job
security feeling common among the Public sector
may be a contributing factor to their lower productivity.
However, the higher percentages of the workers
practicing production deficiency in the Private sector
enterprises than in the Public sector (Figure 1) may be
attributed to their younger ages and shorter periods of
experience (Tables 2 and 3).

Surprisingly, although the workers in the Public
sector gained the higher payment, they were
unsatisfied about their jobs and their employers/
managers, in spite of the satisfaction of the latter about
their performance (Figure 2). This may be attributed to
their older ages (workers aged 30+ years: 87.0% and
77.0% in A and B in comparison to 5.0%, 41.0%, and
28.0% in C, D and E, respectively) and to their
marriage status (e.g. married, divorced, and widowed
workers in the public enterprises are 75.0% in
comparison to 35.1 % in the private sector) (Table 2).
This was anticipated to put more economic and social
burdens on them.

Regarding workers’ Productivity as Related to
Occupational Exposure to the Physical Factors, the
data presented in this study (Figure 3) confirm the
effect of occupational exposure to heat, noise, and
vibration as well poor illumination, as stress factors,
on the productivity of the workers in the garment
industry.

The role of physical hazards in producing stress
was studied previously in variety of research papers.
These studies observed that the workers in industry are
engaged at various jobs in the presence of multi-
stresses like, heat, noise, vibration, and illumination,
etc., which together is likely to cause health
impairment and degrade performance capabilities and,
consequently, reduce productivity quantitatively and
qualitatively.\(^{(24, 28, 31-32)}\) An epidemiological study (32)
conducted to describe the effects of noise in the
working environment on man concluded that the
hearing ability among aged workers is evaluated
(presbycusis) cannot be ignored. This may interpret the
lesser productivity of some aged workers in Public
sector enterprises than in the Private sector, where
younger workers are dominant, in spite of the lower
workers’ noise exposure recorded in the former. Other
studies and reports also concluded the inverse
relationship between worker's noise exposure and the
quantity and quality of work performed, absenteeism,
accidents and disciplinary actions among them.\(^{(28-29,33)}\)

While the health impacts of noise and vibration are
different, the controls are similar, particularly with
respect to elimination and engineering\(^{(34)}\) as well as
diminishing their tolerance to other environmental
hazards.\(^{(35)}\) Worthy noting that the application of the
international occupational safe levels for protecting
workers in the tropics and in developing countries,
since they have been developed for workers in western
countries, most of which are in the temperate zone.
There is a difference in heat tolerance and comfortable
temperature zone for inhabitants of the tropics and
those of other regions. Therefore, different standards
must be established in considering the physical
hazards and the social characteristics of workers in the
developing countries.\(^{(36)}\)

**CONCLUSION AND RECOMMENDATIONS**

The deleterious effects of workers' exposure to
physical hazards; heat, noise and vibration, and
improper illumination on their productivity are clearly
demonstrated in the present study. Attention should be
directed towards the control of these hazards and
improving the work environment of the garment
industry in Egypt, particularly in the Public sector
enterprises.

Meanwhile, the enterprises' managements should
not allow working hours exceeding eight hours daily
as stated by law, increase workers' payment in the
Private sector enterprises, and encourage them to take
a one-day holiday off work weekly, and finally
consider giving workers lunch hour and other rest-
pauses to reduce work stress and improve their efficiency.

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