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ORIGINAL ARTICLE

Occupational Health Hazards and Risks among Construction and Building Workers at EL-Alamein City

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ABSTRACT:

Background: A national governmental plan in Egypt in the recent years has been established, for construction and building of new cities and societies. Construction (refers more broadly to any project in the field and may include constructing a road) and building workers (refers to erecting a building such as a home or business) may suffer morbidity and mortality due to exposure to occupational hazards.

Methods: This cross-sectional study included a total of 208 Construction workers at El-Alamein City, Matruh Governorate. All patients were subjected to full history taking, chest x-ray and pulmonary function tests. **Results**: There was a statistically significant difference between restrictive lung disease and type of work. Also, there is a statistically significant association between obstructive lung disease and work types. Pulmonary function tests were statistically significant and more frequently impaired in concrete, building, plastering, painting and installation of scaffolding workers than other work types. **Conclusions**: Construction and building workers are exposed to silica dust, mechanical hazards, some chemicals, and ergonomic hazards. Construction and building workers show poor following of the preventive rules including wearing of personal protective equipment.

Keywords: Occupational; hazards; construction workers; El-Alamein.

INTRODUCTION

Employees in the construction and building industries are subject to several occupational health risks e.g., dust, fumes, mist, and gases. They are also exposed to physical hazards, such as heat, cold, winds, rain, foggy weather, ultra-violet rays of the sun, electric arc welding and electricity [1]. Health problems related to construction industry include the occupational accidents and occupational poisonings, chronic nature of diseases, musculoskeletal, social, stress, work related diseases, injury and death [2]. Labor is sporadic and ever-changing, and many projects need living away from home and family in labor camps. Increased stress is linked to these aspects of construction labor, as well as a demanding workload and a lack of social support [3]. According to data from the World Health Organization (WHO), construction workers account for more than half of all occupational fatalities and injuries globally [4]. Falls, being struck by things, electrocution, and becoming stuck in or between objects are the leading causes of mortality among construction workers. It was estimated that 21% of occupational deaths worldwide in 2016 were related to construction workers [5]. Risk is determined by calculating the likelihood that a danger may materialize and the seriousness of its effects. An individual's risk perception and risk tolerance play a personal role in their ability to appropriately appraise the danger in each situation [6].

METHODS

This cross-sectional study was done at El-Alamein City, Matruh Governorate. President Abdel Fattah El-Sisi of Egypt officially opened the new city of EL Alamein in the northwest of the country on March 1, 2018. It is situated about 85 kilometers (about 52.82 mi) to the west of Borg El Arab International Airport, New Alamein is situated on the Mediterranean Sea. It was created in accordance

with the exacting specifications of a so-called fourth-generation metropolis. The planned population of New Alamein City North Coast is expected to reach millions. The Egyptian government envisioned New Alamein, which is currently under construction as a hub for government, tourism, and education. In New Alamein, work is in progress on fifteen skyscrapers and high-rise buildings, 10,000 hotel rooms, and three universities. It takes up 50,000 acres to build.

Target population: A total of 208 Construction workers at El-Alamein City, Matruh Governorate were included. There are ten companies, and one company is selected randomly. The number of construction workers at this company was 350, so a sample (208) was taken as a simple random sample.

Inclusion criteria: Building and construction workers above 18 Years. Duration of work: One year at least in the current job، all process of building was included.

Exclusion criteria: To build and construct workers below 18 years، duration of work is less than one year and other or previous jobs.

All selected participants were subjected to the followings:

a) Socio-demographic data such as age, residence, educational level, marital status, BMI, special habits (tobacco smoking – substance abuse), past medical history, monthly income grades. Non-smoker was defined as someone who had smoked an average of less than 1 cigarette per day for less than 1 year or had never smoked. Ex-smoker was defined as someone who had stopped smoking at least 12 months prior to the interview. Current smoker: persons who had smoked greater than 20 packs of cigarettes in a lifetime or greater than 1 cigarette per day for a year.

b) Occupational history which includes nature of job, employment pattern, duration of work (years), number of working hours/days, use of personal protective equipment.

c) Occupational hazards, risks related to construction industry (injury/disease) resulting from construction work.

Chest x-ray: Postero-anterior view for workers having duration of work > 10 years

Pulmonary function tests were done by using portable spirometer (Hand-held spirometer PFT USB, German) for all participants as it can be deteriorated gradually before 10 years.

A pilot study was carried out on 10 % of the required sample size in different construction sites to test the validity of questionnaire with the most appropriate terms. It also helps to estimate time needed for data collection. No need for any modification. Pilot sample was excluded from the study.

Process: All workers were personally interviewed by the investigator and were asked to participate in the current study and fill in the questionnaires after providing their oral consent.

Ethical approval:

Institutional Review Board-Zagazig University (IRB number 9628) approval was obtained. Informed written consent from every worker included in the study was obtained.

Statistical analysis:

The Statistical Package for Social Sciences (SPSS) for Windows Version 22 was used to revise, code, tabulate, and introduce the acquired data to a personal computer for analysis. While mean and standard deviation (SD) were used to represent quantitative variables, frequencies and percentages were used to represent qualitative data. The Fisher's exact test and the Chi square test were applied, with a significance level of $p < 0.05$.

RESULTS

This cross-sectional study was conducted on 208 construction workers, the mean age of our studied group was 36.59±12.07, and the mean of BMI was 27.31±5.16 (Table 1).

The most common jobs among studied participants were concrete formation 30.28%, followed by building (18.26%), followed by blacksmithing and installation of scaffolding worker (7.21%) & (6.73%) respectively. Their employment pattern was not permanent (89.9%), their daily shift was 89.4% with mean duration of work was 16.17±11.31 years and mean number of working hours/days was 9.19±2.57. The majority used PPE was PPE steel hats (95.7%) followed by boats and gloves (92.3% - 74%) respectively (Table 2).

The most common physical hazards reported by the studied population was noise (72.1%), followed by broken floor & slippery floors (64.9%, 59.1%) respectively. The most common chemical hazards reported by our studied groups were cement, sand dust (88.5%), followed by concrete (62%) then toxic gases (such as Carbon Monoxide, Chlorine Dioxide, Methane, Hydrogen Sulphide and Volatile Organic Compounds) & solvent paints (23.6%, 13%) respectively, and 4.8% exposed to biological hazard (such as mold and fungi (which can result

from water damage, such as after a flood or a leak), dust (which can contain harmful chemicals and silica), animal droppings and waste (which can carry viruses and bacteria). Most mechanical hazards found in our studied group were trauma and injuries (46.6%), friction and trapping (19.2) followed by hitting by rapidly moving equip. (17.3%). The most common ergonomic risk was inappropriate working posture (82.7%), followed by prolonged standing, trunkal twisting (76%) (Table 3).

Abnormality in chest x-ray was in small opacities (defined as any opacity less than 1 cm that is present in the image, including p,q,r,s,t,u. categories) 25.48% and large opacities (defined as any opacity greater than 1 cm that is present in the image, including A, B, C categories.) was 17.78%. .20.67% detected restrictive lung disease (defined as a decrease in the total volume of air that the lungs are able to hold) and 16.82% obstructive lung disease (defined as conditions that make it hard to exhale all the air in the lungs with difficulty fully expanding lungs with air). The mean of FEV1 was 2.17, FVC was 2.17, and FEV1/FVC was 81.18 (Table 4).

As regards association between type of work and X-ray findings, there is no statistically significant difference between studied groups regarding building, plastering, carpentering, painting, ceramic worker, digging, installation of scaffolding, driving, construction, blacksmithing worker, plumbing, electricians and laborer. While there is statistically significant difference between studied groups regarding concrete formation (p=0.019) (Table 5).

Pulmonary function tests were statistically significant more frequently impaired in concrete worker, building worker, plastering, painting, installation of scaffolding than other work types (p <0.0001) (Table 6).

There was a statistically significant difference (p <0.0001) between restrictive lung disease and type of work (such as concrete formation**,** building, plastering, carpentering, paintering, ceramic worker, digging, installation of scaffolding and blacksmithing worker). Also, there is a statistically significant difference (p=0.002) between obstructive lung disease and work types (such as concrete formation**,** building, plastering, carpentering, paintering, ceramic worker, digging, installation of scaffolding and construction) (Table 7).

Table 1: Socio-economic characteristics among studied participants

		(N = 208)	
Age (years)	mean±SD	36.59 ± 12.07	
BMI	mean±SD	27.31 ± 5.16	
		N	%
Education	Non educated	58	27.9
	educated	150	72.1
Marital status	Married	149	71.6
	Unmarried (single, divorced, widowed).	59	28.4
Tobacco smoking	non-smoker	60	28.8
	Ex-smoker	35	16.8
	Current smoker	113	54.3
Past medical. history	Diabetes	12	5.8
	Atopic history	36	17.3
	Hypertension	12	5.76
Residence	Urban	82	39.4
	Rural	126	60.6
Monthly income enough	Not enough	101	48.6
	Enough	97	46.6
	More than enough	10	4.8

Table 2: Occupational characteristics and PPE using among the studied group

		(N = 208)	
		N	**%**
Monthly income	Not enough	101	48.6
	Enough	107	51.4
Nature of task	Digging	4	1.92
	Scaffolding	14	6.73
	Carpentering	8	3.84
	Concrete formation	63	30.28
	Construction	12	5.76
	Black smith workers	15	7.21
	Driving	11	5.28
	Building	38	18.26
	Painting	11	5.28
	Electricians	6	2.88
	Laborers	5	2.40
	Plumbing	5	2.40
	Ceramic worker	4	1.92
	Plastering	12	5.76
Employment pattern	Permanent	21	10.1
	Temporary	187	89.9
Shift work	Day	186	89.4
	Night	22	10.6
Duration of working (years)	Mean ±SD	16.17 ± 11.31	
Number of working hours/day (hours)	Mean ±SD	9.19 ± 2.57	
PPE using	Hard belt	132	63.5
	Vest	139	66.8
	Safety boat	192	92.3
	Respirator	3	1.4
	Hat	199	95.7
	Gloves	154	74

Table 3: Occupational hazards among the studied group

	(N = 208)	
	N	**%**
Physical hazards		
Noise	150	72.1
Poor illumination	81	38.9
Electricity	55	26.4
Fire	15	7.2
Slippery floors	123	59.1
Broken stairs	135	64.9
Vibration	53	25.5
Chemical hazards		
Cement, sand dust	184	88.5
Concrete	129	62
Toxic gases and chemicals	49	23.6
Solvents paints	27	13

	(N = 208)	
	N	%
Biological hazards		
Yes	10	4.8
No	123	59.1
Sometimes	75	36.1
Mechanical		
Trauma with injuries	97	46.6
Friction with trapping	40	19.2
Hit by rapidly moving equipment	36	17.3
Ergonomical risk		
Prolonged standing and trunk twisting	158	76
*Inappropriate working posture	172	82.7

Table 4: Chest X-ray, Lung function tests findings among the studied group

	(N = 208)		
	N	%	
Chest x-ray			
Small opacities*	53	25.48	
Large opacities**	37	17.78	
Lung function tests			
FEV1	2.17 ±0.85		
FVC	2.17±0.79		
FEV1/FVC	81.18±15.45		
Restrictive lung disease	43		20.67
Obstructive lung disease	35		16.82

Table 5: Association between type of work and X-ray findings

X ray findings	Small opacities (n=53)		Large opacities (n=37)		Test	P-value
	N	%	N	%		
Concrete formation	17	32.07%	21	56.75%	5.441	0.019
Building	12	22.64%	6	16.21%	0.562	0.453
Plastering	3	5.66%	3	8.1%	0.21	0.646
Carpentering	2	3.77%	1	2.7%	0.078	0.78
Paintering	5	9.43%	1	2.7%	1.587	0.207
Ceramic worker	1	1.88%	1	2.7%	0.067	0.795
Digging	1	1.88%	1	2.7%	0.067	0.795
Installation of scaffolding	6	11.32%	1	2.7%	2.256	0.133
Driving	1	1.88%	1	2.7%	0.067	0.795
Construction	1	1.88%	0	0%	0.706	0.4
Blacksmithing worker	1	1.88%	1	2.7%	0.067	0.795
Plumbing	1	1.88%	0	0%	0.706	0.4
Electricians	1	1.88%	0	0%	0.706	0.4
Laborer	1	1.88%	0	0%	0.706	0.4

Table 6: Pulmonary function tests in relation to the type of work

	FEV1		FVC		FEV1/FVC	
	mean	SD	mean	SD	mean	SD
Concrete formation	2.95	0.46	2.09	0.11	69.99	16.7
Building	2.92	0.12	2.17	0.21	71.4	15.4
Plastering	2.89	0.34	2.21	0.23	72.9	13.1
Carpentering	2.83	0.16	2.25	0.20	75.3	12.7
Painting	2.74	0.18	2.22	0.23	77.2	18.2
Ceramic workers	2.53	0.21	2.43	0.22	74.3	14.3
Digging	2.45	0.22	2.46	0.24	77.7	15.9
scaffolding	2.44	0.23	2.48	0.34	83.4	13.6
Driving	2.08	0.13	2.65	0.31	87.4	12.7
Construction	2.12	0.17	2.79	0.35	86.1	11.8
Blacksmithing	2.10	0.13	2.83	0.23	85.4	8.8
Plumbing	2.09	0.12	2.85	0.36	84.6	7.5%
Electricians	2.07	0.17	2.93	0.44	89.12	11.3
Laborer	2.08	0.11	2.835	0.18	88.7	11.4
P-value	<0.0001		<0.0001		<0.0001	

Table 7: Restrictive lung disease and obstructive lung disease in relation to the type of work

			Test	P-value
	N	%		
Restrictive lung disease in relation to the type of work N=43				
Concrete formation	11	25.58%	X^2=33.6	<0.001
Building	7	16.27%		
Plastering	3	6.97%		
Carpentering	1	2.32%		
Paintering	3	6.97%		
Ceramic worker	1	2.32%		
Digging	3	6.97%		
Installation of scaffolding	4	9.30%		
Driving	0	0.00%		
Construction	10	23.25%		
Blacksmithing worker	0	0.00%		
Plumbing	0	0.00%		
Electricians	0	0.00%		
Laborer	0	0.00%		
Obstructive lung disease N=35				
Concrete formation	10	28.57%	26.009	0.002
Building	6	17.14%		
Plastering	4	11.42%		
Carpentering	2	5.71%		
Painting	2	5.71%		
Ceramic worker	0	0%		
Digging	1	2.85%		
Installation of scaffolding	3	8.57%		
Driving	7	20%		
Construction	8	22.85%		

P value < 0.05 is statistically significant, x^2= qui square test.

DISCUSSION

The current study shows that the most physical hazards reported by the studied group were noise (72.1%), followed by trauma i.e.: stairs and slippery floors. This high prevalence of noise is due to the omission of ear protective equipment.

These results were not consistent with the results of Mohamed et al. [7] which showed that the most physical hazards among construction workers was slippery floors (41.73%), but noise was the least percentage (21.5%), properly due to wearing of ear protective equipment.

This study shows that the most common chemical hazards reported by our studied group were cement, sand dust (88.5%) followed by concrete (62%), gases, solvents, paint and this high level of cement, sand dust may be attributed to omission of wearing of respiratory protective equipment. Only 4.8% exposed to biological hazards that may be due to clean environment in a new city.

While Mohamed et al. [7] found that 17.7% of builders were exposed to cement materials and 29.2% of painters and steel workers were exposed to volatile substances (kerosene and tanner). The low level of exposure was caused by wearing respiratory protection, as reported by 22.2% and 20% of roof laying workers and excavation workers, respectively, who were exposed to elevated levels of dust throughout their everyday job.

This study shows that most mechanical hazards found in our studied group was trauma and injury (46.6%), followed by friction and trapping (19.2%), hitting by rapidly moving equip. (17.3%) and shows the most common ergonomical risks was inappropriate working posture (82.7%), followed by prolonged standing, trunk twisting (76%).

Furthermore, these outcomes concurred with a study conducted by Amal et al. [8] which demonstrated a statistically significant relationship between the incidence of injuries and mechanical and ergonomic hazards.

These findings were in line with those of Mohamed et al. [7], who reported that heavy tools and quickly moving parts were encountered by 21.6% of erection steel workers.

This study showed that X-ray abnormalities were 25.48%, small opacities, 17.78%, large opacities. It also showed that restricted lung disease was detected in 20.67% and showed that obstructive lung disease was detected in 16.82%. The mean FEV1 was 2.17±0.85, mean FVC was 2.17±0.79, mean FEV1/FVC was 81.18±15.45.

This study showed that abnormal X ray findings were statistically significant more frequent in concrete formation than other work jobs. Also, this study showed that there is no statistically significant association between obstructive lung disease and the different work types among construction workers. This study showed that restrictive lung disease was statistically significant more frequent in concrete worker, building, plastering, painting, installation of scaffolding than other work types.

These findings were in line with those of Nij et al. [9] "Radiographic abnormalities among construction workers exposed to quartz containing dust," which demonstrated a correlation between cumulative dust exposure and radiographic abnormalities as well as an increased risk of abnormalities among workers with high exposure expectations.

These results were also in agreement with Hines et al. [10] “Restrictive spirometer pattern among construction trade workers” study that showed prevalence of restrictive lung disease as high as (28.6%). Restrictive lung was significantly associated with both parenchymal and pleural changes seen by chest X-ray increasing risk for mortality.

These results also were in line with those of Johncy et al. [11] "Dust exposure and lung function impairment in construction workers," which found that there was a significant drop in the mean values of FVC, FEV1, FEV1/FVC, and PEF25-25%¬ and that workers engaged in building and construction were at risk of developing impaired lung function due to the high level of dust generated at construction sites. The length of time spent exposed to dust enhanced this impairment.

In our investigation, 16.82% of participants had obstructive lung disease. Dement et al. [12] "A case-control study of air ways obstruction among construction workers" concluded that occupational exposure accounts for 18% of the COPD risk among construction workers, and these results were in line with that estimate. The risk increased by occupational exposures and smoking, and there was a correlation between dust exposure and obstructive lung disease in construction workers.

This study showed that pulmonary function tests were statistically significant more frequent impaired in concrete worker, building worker, conch worker, painter installation of scaffolding than other work types and this showed that lung impairment occurred due to continuous inhalation of cement and sand dust.

These outcomes were in line with the research conducted by Nedal et al. [13] on "the effect of cement dust on the lung function in a cement factory, iron," which found that because of their extremely elevated level of exposure to cement dust, the exposed workers had significantly lower ventilator indices of FVC, FEV1, and FEV1/FVC than the control group.

CONCLUSIONS:

Construction and building workers are exposed to pneumoconiosis especially silicosis and musculoskeletal disorders. Construction & building workers show poor following the preventive rules including wearing personal protective equipment.

Declaration of interest

The authors report no conflicts of interest. The authors along are responsible for the content and writing of the paper.

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REFERENCES

1. Karnena MK, Konni M, Saritha V. Occupational health problems of construction workers. Ecological and health effects of building materials. Springer: Cham, Switzerland 2022; 405-26.
2. Mohamed AK. Occupational hazards and their relation with health problems among construction building workers at El Sherouk City. Am. J. Nurs 2017; 5 (3): 96-103.
3. Hatami SE, Khanjani N, Alavinia SM, Ravandi MR. Injuries and their burden in insured construction workers in Iran, 2012. Int J Injury Contr Safety Prom 2017; 24:89–96.
4. Nadhim EA, Hon C, Xia B, Stewart I, Fang D. Falls from height in the construction industry: A critical review of the scientific literature. IJERPH 2016; 13(7): 638.
5. OSHA. Personal protective equipment. 2017. Retrieved from https://www.osha.gov/personal-protective-equipment.
6. Girlando A, Grima S, Boztepe E, Seychell S, Rupeika-Apoga R, Romanova I. Individual risk perceptions and behavior. IJCISS 2021; 367-436.
7. Mohamed AK. Occupational hazards and their relation with health problems among construction building workers at El Sherouk City. Am. J. Nurs 2017; 5 (3): 96-103.
8. Amal E, Adel E, Maged M. Construction safety and occupational health education in Egypt, the EU, and US firms. Open J. Civ. Eng. 2012.
9. Nij ET, Burdorf A, Parker J, Attfield M, van Duivenbooden C and Heederik D. Radiographic abnormalities among construction workers exposed to quartz containing dust. Occup Environ Med. 2003; 60(6): 410-7.
10. Hines SE, Dement J, Cloeren M, Cranford K, Quinn PS, Ringen K. Restrictive spirometry pattern among construction trade workers. Am J Ind Med 2023; 66 (6): 484-99.
11. Johncy SS, Ajay KT, Dhanyakumar G, Raj NP, Samuel TV. Dust exposure and lung function impairment in construction workers. J Physiol Biomed Sci 2011; 24(1): 9-13.
12. Dement J, Welch L, Ringen K, Quinn P, Chen A, Haas S. A case-control study of airways obstruction among construction workers. Am. J. Ind. Med 2015; 58(10): 1083-97.
13. Alnawaiseh N and Gamal FM. The Effect of Cement Dust Exposure on Lung Function among Cement Factory Workers. BPJ 2022; 15(4): 2061-68.

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