

# Occupational Health Hazards and Safety Measures among workers at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt

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## Abstract

**Background:** Occupational Health has significantly evolved, becoming a crucial component of national economies, with occupational health and safety units operating inside the personal health sector, fundamental to global civilization. **Aim:** Assess the occupational health hazards and safety measures among workers at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt. **Design:** A cross sectional design was utilized in this study. **Setting:** The study was performed at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt. **Sample:** A systematic random sample of 332 workers was employed. **Tools:** two tools. **Tool (I):** An interviewing questionnaire sheet comprised three parts: part one: personal data and work data of participants. Part two: past History of occupational hazards. **Part three:** Worker's knowledge about occupational health hazards. **Tool II:** Observational checklist to evaluate worker's practice and environmental sanitation. **Results:** The study revealed that 46.1% of the workers possess (an adequate level of) good knowledge about occupational hazards. Additionally, 76.2% of the workers demonstrated had a satisfactory level of practice concerning the use of Personal Protective Equipment (PPE). **Conclusion:** There was a statistically significant association correlation ( $P = 0.043$ ) among the overall level of knowledge and the overall level of practice within the studied workers. **Recommendations:** Regular periodic screening for all workers for early detection of any health problems.

**Keywords:** Occupational Hazards, Safety Measures

## Introduction

Occupational Health is a multi-disciplinary field that addresses all facets of health and safety in the workplace, emphasizing the prevention of occupational risks. The enjoyment of these standards is a fundamental human right that should be granted to every worker, irrespective of the type of their employment. With OHS regulations implemented, employees may perform their duties in a safe and secure workplace, devoid of dangers (De Cieri & Lazarova, 2021).

An occupational hazard refers to a risk encountered in the job. Occupational dangers may include several categories such as chemical hazards, biological hazards (biohazards), psychological hazards, and physical hazards. The phrase "occupational hazard" denotes both long-term and short-

term concerns linked to the working environment and constitutes a domain of research within occupational safety, health, and public health. Immediate hazards may include physical harm; however prolonged risks may elevate the likelihood of getting cancer or cardiovascular illness (Kumar et al., 2019).

Occupational Health has significantly evolved, becoming a crucial component of national economies, with OHS units operating inside the personal health sector, fundamental to global civilization. The Wellbeing and Main Health 1906 initiative in Milan is a crucial advancement in addressing contemporary world issues. The workforce was established by the Permanent Commission on Safety to advocate employee health in workplace health, which was subsequently renamed the International Commission on

Occupational Health (ICOH) by addressing workplace concerns and conditions (Xiaojun & Ken, 2020).

Safety Measures refer to any prudent actions undertaken by the responsible individual to avert accidents or severe injuries, or to eradicate hazardous conditions. These measures encompass deliberate actions and strategies implemented to enhance the overall safety of a specific task, process, or organization as a whole. Safety is the condition of being safeguarded from danger or undesirable results (Thangam et al., 2022).

The occupational health nurse, safety professional, ergonomist, and industrial hygienist may cooperate on various instructional seminars addressing workplace risks as part of the team's main preventative plan. The occupational health nurse, occupational physician, workplace management, and community hospital may provide monthly examinations for workers at no cost as part of secondary preventive strategies (Karppinen et al., 2021).

### Significance of the Study

Occupational hazards are the major source of morbidity and mortality among the factory workers owing to exposure to many hazardous situations in their daily practices. Worldwide, Yearly over 2 million people worldwide die of occupational injuries and occupation related diseases (Burke and Richardsen, 2019).

In Egypt, fertilizers factories are one of the most important chemical industries which based on the usage of numerous types of chemicals in large quantities (Al-Aees, 2021). During manufacturing of fertilizers, workers may be exposed to several occupational hazards (Mohammed et al., 2022).

The primary goals of occupational health studies are to reduce hazard exposure and to prevent disease and injury. These goals can be met through

assessment and monitoring of the workplace and the general environment for health and safety measures (Jaiswal, 2021).

### Aim of the study

This study aims to evaluate the occupational health hazards and safety measures among workers at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt.

### Research questions

1. What are the occupational health hazards among workers at Egyptian Chemical and fertilizers Industries Company?
2. What are the level of worker's knowledge about safety measures practice at Egyptian Chemical and fertilizers Industries Company?

### Subject and methods

#### Research design

A cross sectional research used.

#### Setting:

The study was performed at Egyptian Chemical and fertilizers Industries Company in Aswan city, Upper Egypt.

#### Sampling:

Systematic random sample was used in this study. The population consisted of 1,953 workers across various departments, with a final sample size of 332 workers and calculated according to the following equation: (Yamane, 1967).

$$n = \frac{N}{1 + N(e)^2} = \frac{1953}{1 + 1953(0.05)^2} = 332 \text{ Worker.}$$

n= the sample size

N= total population

e= Margin of error (0.05)

#### Inclusion criteria:-

- 1- Workers aged over 18 years.

- 2- Both sexes(male &female).
- 3- Workers who consented to engage in the study.

**Exclusion criteria:-**

- 1-Workers who included in another research study simultaneously.
- 2- Workers who considered by their clinician to be unwell to participate.

**Tools for Data Collection:** Data collection was conducted using two tools.It was designed by the researcher following a review of related literature(Mohamed et al., 2017).

**Tool I:** The interviewing questionnaire sheet comprised three parts:

**Part (1):**

- personal characteristics of the workers, as (age, number of family members, marital status, educational level, safety measures and health training courses, and number of courses).
- Work-related data of participants, including work department, type of work, working hours, years of experience, and health services as (nursing services, periodic medical examinations, and pre-employment examinations).

**Part (2):**History of occupational health hazards, that comprised two questions about previous work-related injuries and experiencing any diseases.

**Part (3):**Workers' knowledge about occupational health hazards. It was included questions about the definition, types of occupational health hazards, health problems related to work as (musculoskeletal, respiratory, vision, skin problems).

**The scoring system of knowledge:**

The total grades of knowledge were (30); one point was awarded for every correct

response, and zero was awarded for every incorrect response or for responses indicating "don't know". The total score was determined by adding the points together and then translated to a percentage score as the following:

- Less than 50%:poor knowledge.
- 50% to 70%:fair knowledge.
- More than 70%: good knowledge(Mobed et al., 2019).

**Tool II-Observational checklist:**

**Part (1):** Evaluate the workers' practices, it Involved the use of personal protective equipment(PPE), including (9 items) overall uniform, ear muffs, respiratory mask, safety boots, protective apron, asbestos gloves, eye goggles, safety face shield, and head cover (cap).

**Scoring system:**

Done= 1

Not done= 0

**Part (2):** Involved environmental and sanitation condition of the studied fertilizer factory which covered 9 items area of work, floor, emergency exit, health clinic, fire protection, material handling, storage, machines, employee facilities (facilities kept clean and properly).

**Scoring system:**

Available = 1

Not available=0

The total score of the environmental and sanitation condition considered safe if score was  $\geq 80\%$  (7:9) and considered unsafe if it $< 80\%$  (1:6).

**Validity of the study tool:** - The validity of the instruments was carried out by five academic specialists from the community health nursing department. They examined

the tools to make sure they were understandable, applicable, comprehensive, and clear.

**Reliability of the study tool:** - Reliability was applied by the researchers for testing the internal consistency of the tools and the value of Cronbach's Alpha reliability was 0.87 for knowledge and 0.79 for practices.

#### **Ethical consideration:**

Approval to perform the study was acquired from the authorized persons involved. The title, purposes, and tools were reviewed, and the study procedure was demonstrated to acquire their participation. This participation is necessary for the researcher to engage with the study sample at the specified location. The verbal consent was obtained, and a brief orientation on the study's objectives was provided. The participants were also assured that all information collected would remain private and be employed solely for the study's objective. To maintain confidentiality and anonymity, no names are needed on the forms. They were also notified that they had the right to withdraw from the study at any time without justification.

#### **Pilot study:**

A study was performed that included approximately 32 workers (10%) who were included in the sample. The objective of the pilot study was to assess the simplicity of the tool and the time required to fill out the questionnaire. No modification were done so the pilot study were included in the total number of the study sample.

#### **Field work phase:**

The data was collected during the period from the beginning of March 2023 to the end of August 2023, two days per week. Before beginning the process of gathering characteristics, a brief explanation of the study's goal was given to the workers. Following their clarification of the instructions, the workers completed a self-administered knowledge questionnaire. The average time required to finish each self-administered questionnaire was approximately 20 minutes, with 6-7 workers per day.

#### **Administrative design:**

Written approval letter illustrating the purpose of the study was obtained from the Dean of Nursing faculty to the general manager of the Egyptian Chemical and fertilizers Industries Company asking for collaboration and agreement to perform the study.

#### **Statistical design:**

Data were classified, coded and analyzed according to suitable statistical approaches and tests then results were presented in suitable tables, figures, and graphics. Data were then introduced into Statistical Package for the Social Sciences (SPSS version 23.0) software for analysis. Quantitative data were provided as mean and standard deviation (SD) while qualitative data were expressed as frequency and percentage. The observed differences and associations were deemed statistically significant when  $P \leq 0.05$ .

#### **Results**

**Table (1):** Shows the personal distribution of workers at Egyptian Chemical

and fertilizers Industries Company. more than half (57.5%) of the studied workers were the aged group more than 35, with a mean age  $38.95 \pm 9.36$ , and 43.3% had secondary education. Also, 77.5% of them were married and 72.5% of them had 4-5 family members. Additionally, 69.0% of them hadn't attended any training courses on safety and occupational health and safety.

**Table (2):** reveals that 63.9% of the studied workers were technician and the majority 93.7% of them were working for 6-8 hours daily. Regarding workers 62.1% of them had more than 5 years. Additionally, the majority (93.9+86.7) of them reported that pre- employment examination and nursing services respectively.

**Table (3):** show that, hypertension and diabetes mellitus were the most common chronic disease among (48.8% and 46.1% )of the studied workers respectively. Regarding previous injuries during work, more than half (56.3%) of the studied workers reported dermatitis.

**Figure (1):**It Illustrates that, 46.1% of the studied workers had good level of knowledge. While, 37.1% of them had fair level of knowledge and only 16.8% of them had poor level of knowledge.

**Table (4):** Reveals that the majority (93.1%) of the studied workers reported use of respiratory mask. Also, 88.8% of them reported use of safety boots. Additionally, 83.1% of them reported use of safety face glass shield. On the other hand, 40.9% and 40.3% of the studied

workers reported not use of asbestos gloves and ear muff respectively.

**Table (5):** Distributed that the majority of (91.8%) of the studied workers reported availability of safety floor; free from protruding nails, holes and splinter. Also, 90.1% of them reported availability of ambulance. Additionally, 89.7% of them reported availability of emergency equipment in health clinic. Also, 90.1% of the studied workers reported that employee facilities kept clean and proper. Also, 89.7% of them reported point of operation guards in place, and working on all operating equipment. Additionally, 89.1% them reported that materials are stocked interlocked and limited to height to maintain stability.

**Table (6):** Shows that, there was a statistical significant differences relationship between total levels of practice of the studied workers and their age, type of work and years of experiences at (P-value=0.043, 0.003, 0.003 and 0.035) respectively. While, there was no statistical significant relationship between total levels of practice of the studied workers and their educational level, marital status, previous receiving training courses and work department at (P-value=0.352, 0.487, 0.685 and 0.739) respectively.

**Table(7):** Illustrates that, there was a positive statistical significant difference correlation between total level of knowledge and total level of practice among the studied workers with statistical significant association p- value=0.043

**Table 1:** Distribution of the studied workers based on their personal demographic characteristics at Egyptian Chemical and fertilizers Industries Company in Aswan City, Upper Egypt 2023 (n=332).

Items	N	%
<b>Age( inyears)</b>		
<20	26	7.8
20-35	77	23.2
>35-50	191	57.5
>50	38	11.5
<b>Mean <math>\pm</math> SD</b>		<b>38.95<math>\pm</math>9.36</b>
<b>Educational level</b>		
Primary	42	12.7
Preparatory	55	16.6
Secondary	157	47.3
University and high	78	23.4
<b>Marital status</b>		
Single	55	16.6
Married	257	77.4
Divorced	9	2.7
Widow	11	3.3
<b>Number of family members</b>		
3members	22	6.7
4-5	241	72.5
>5	69	20.8
<b>Training courses on safety and occupational health</b>		
Yes	103	31.0
No	229	69.0
<b>If yes,number of courses (n=103)</b>		
1-2	62	60.1
3-4	28	27.2
5-6	13	12.7
<b>Training course topics (n=103)#</b>		
Typesof fertilizers	72	69.9
The correct way to make fertilizers	98	95.1
Health risks of fertilizers	67	65.0
Methods of action when any damage occurs from fertilizers	74	71.8
Methods of storing fertilizers	91	88.3
Firstaid	103	100.0

# Some participants had more than one response

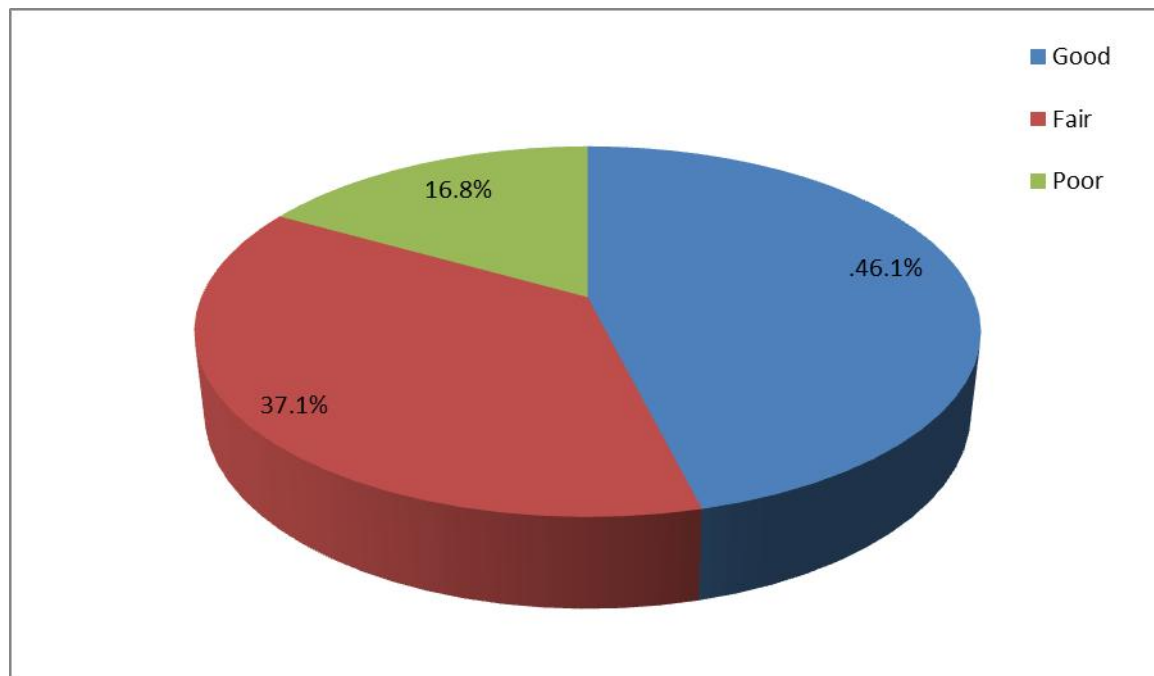
**Table 2:** Distribution of the studied workers based according to working data at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt 2023 (n= 332)

Items	N	%
<b>Department of work</b>		
Electricity	97	29.3
Laboratory.	67	20.1
Nitrogen production station	83	25.0
Packaging	85	25.6
<b>Type of work</b>		
Auxiliary services.	42	12.7
Technician	212	63.9
Specialist (production, laboratory)	78	23.4
<b>Working hours</b>		
6-8 hrs	312	93.7
>8 hrs	20	6.3
<b>Years of experience</b>		
<5	55	16.5
5-10	206	62.1
>10	71	27.4
<b>Health services #</b>		
Pre-employed examination	288	86.7
Nursing services (medical supplies, first aids, health education)	312	93.9
Periodic medical Examination	139	41.8

**#More than health services****Table 3:** Distribution of the studied workers according to past history of chronic disease and previous injuries during work at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt 2023 (n=332).

Items	N	%
<b># Chronic disease</b>		
Hypertension(HTN)	162	48.8
Diabetes mellitus(DM)	153	46.1
Bronchial asthma	46	13.8
skin allergy	12	3.6
auditory problems	12	3.6
Yes	176	53.1
No	156	46.9
<b># Previous injuries related to work</b>		
Burn	18	5.4
Fracture	21	6.3
Bleeding	69	20.7
Wound	69	20.7
Dermatitis	187	56.3
Others	26	7.8
Yes	219	66.0
No	113	34.0

# more than one answer



**Figure (1):** Total score of knowledge regarding occupational health hazards among studied worker at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt 2023 (n= 332).

**Table (4):** Distribution of the studied workers according to their practice regarding using of the PPE at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt 2023 (n=332).

Protective Equipment	Done		Not done	
	N	%	N	%
Overall uniform	247	74.3	85	25.7
Head cover (cap)	236	71.1	96	28.9
Safety face glass shield	276	83.1	56	16.9
Eye goggles	260	78.4	72	21.6
Asbestos gloves	196	59.1	136	40.9
Protective apron	224	67.5	108	32.5
Safety boots	295	88.8	37	11.2
Respiratory mask	309	93.1	23	6.9
Ear muff	198	59.7	134	40.3



**Table 5:** Distribution of the studied workers according to environmental safety and sanitation at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt 2023 (n=332).

Items	Available		Not available	
	N	%	N	%
<b>Area of work</b>				
Clean	295	88.8	37	11.2
Organized	268	80.7	64	19.3
Safety floor; free from protruding nails, holes and splinter.	305	91.8	27	8.2
<b>Floor</b>				
All stairways have hand rail, Stairways strong adequately illuminated and slip resistant.	236	71.1	96	28.9
<b>Emergency Exit</b>				
Exit adequate to allow prompt escapes.	239	71.9	93	28.1
Exit Clear marked	224	67.4	108	32.6
<b>Health Clinic</b>				
Prepared with emergency equipment.	298	89.7	34	10.3
Presence of ambulance.	299	90.1	33	9.9
First aid supplies.	265	79.8	67	20.2
<b>Fire protection</b>				
Fire extinguishers present for all types of fire.	189	56.9	143	43.1
Fire extinguishers suitable in number.	225	67.7	107	32.3
Fire extinguishers location Clearly marked.	286	86.1	46	13.9
<b>Material handling</b>				
Materials are stocked interlocked and limited to height to maintain stability.	296	89.1	36	10.9
<b>Storage</b>				
Storage area kept free of tripping and free from fire and explosion	264	79.5	68	20.5
Drainage provided in storage area	255	76.8	77	23.2
Warning signs of clearance limits Posted	284	85.5	48	14.5
<b>Machines</b>				
Point of operation guards in place, and working on all operating equipment.	298	89.7	34	10.3
Machines have properly guard System	196	59.1	136	40.9
<b>Employee facilities</b>				
Facilities kept clean and properly	299	90.1	33	9.9

**Table (6):** Relation between personal characteristics of the studied workers and their total level of practice at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt 2023 (n=332).

Socio-demographic characteristics		Total level of practice				X2	P-value
		Satisfactory (n=253)		Unsatisfactory (n=79)			
		N	%	N	%		
Age (in years)	<20	21	6.3	5	1.5	2.570	0.043* (S)
	20-35	54	16.3	23	6.9		
	>35-50	150	45.2	41	12.3		
	>50	28	8.4	10	3.0		
Educational level	Elementary	29	8.7	13	3.9	2.091	0.352 (NS)
	Preparatory	20	6.7	35	10.5		
	Secondary	161	48.5	51	15.4		
	University	63	19.0	15	4.5		
Marital status	Single	49	14.8	6	1.8	2.815	0.487 (NS)
	Married	189	56.9	68	20.5		
	Divorced	8	2.4	1	0.3		
	Widow	7	2.1	4	1.2		
Training courses on safety and occupational Health	Yes	81	42.4	22	6.6	3.489	0.685 (NS)
	No	172	51.8	57	17.2		
Department of work	Electricity	68	20.5	29	8.7	6.605	0.739 (NS)
	Laboratory	58	17.5	9	2.7		
	Nitrogen production station	55	16.6	28	8.4		
	Packaging	72	21.7	13	3.9		
Type of work	Auxiliary.	30	9.0	12	3.6	4.869	0.003* (S)
	Technician	163	49.1	49	14.8		
	Specialist	60	18.1	18	5.4		
Years of experience	<5	33	9.9	22	6.6	8.898	0.035 * (S)
	5-10	172	51.8	34	10.2		
	>10	48	14.5	23	6.9		

X<sup>2</sup> test= Chi-Square test P-value > 0.05= Non-significant (NS) \*P-value ≤ 0.05= Significant (S)

**Table (7):** Correlation between total level of knowledge and total level of practice among the studied workers at Egyptian Chemical and fertilizers Industries Company at Aswan City, Upper Egypt 2023 (n=332)

Variables	Total level of knowledge	
	R	P-value
Total level of practice	0.540	0.043*

r= Pearson correlation coefficient

\*P-value ≤ 0.05= Significant (S)

## Discussion

The analysis of the investigated workers' personal features (**Table 1**) revealed that over fifty percent belonged to the age range from 35-50 years and less than two-thirds had secondary education.

The findings concurred with **Al-Mousa et al., (2022)** who investigated "Occupational Safety Climate and Hazards in the Industrial Sector: Gender Differences Perspective, Saudi Arabia," revealing that less than half of the surveyed workers had attained a high school education. This conclusion aligns with **Lu et al., (2020)** who investigated the "Effects of occupational hazards on job stress and mental health of factory workers and miners," revealing that less than half of the workers tested were aged 45 years or older. Furthermore, this outcome aligned with the findings of **Pandeya et al., (2021)** who investigated the "Occupational Health Risk among Selected Cement Factory Workers in Dang District of Nepal" and discovered that almost three-quarters of the participants were aged 40 years or younger, and fewer than half had a secondary education.

Furthermore, over three-quarters of them were married, and less than three-quarters had 3-5 family members. Furthermore, almost two-thirds of them had not participated in training courses concerning safety and occupational health. This outcome corroborated the research conducted by **Zayed et al., (2020)** titled "Assessment of Respiratory Health and Environmental Safety Measures in the Phosphate Fertilizer Industry in the Middle Region of the Nile Delta, Egypt," which indicated that most of the surveyed workers were married, and fewer than one-third had participated in training courses post-employment. This result aligns with the findings of **El-Ghany & Mahmoud, (2019)** who investigated the "Effect of

educational intervention regarding first aid and ergonomics on enhancing bakery workers' performance related to occupational hazards in Zagazig City," revealing that most of the participants had a moderate family size of 3-5 members.

The analysis of the workforce distribution based on employment data (**Table 2**) revealed that less than two-thirds of the participants were technicians, with the majority working 6-8 hours each day. Furthermore, less than two-thirds have 5 to 10 years of expertise. Furthermore, most of them indicated pre-placement assessments and nursing services.

This finding was corroborated by **Abdelwahab et al., (2019)** in their study titled "Effect of Health Education Program on Knowledge and Practice of Workers Regarding Occupational Health Hazards at Sugar Factory," which demonstrated that the majority of workers were employed for 6-8 hours every day. However, this outcome contrasted with **Chepchumba, (2020)** who investigated "Assessment of Occupational Hazard Awareness and Safety Measures Among Quarry Workers in Bomet County, Kenya," revealing that over three-quarters of workers labored for 9-12 hours, and more than one-third had been employed for 1-4 years.

The analysis of the examined workers' distribution based on their medical history and prior work-related injuries (**Table 3**) revealed that hypertension and diabetes mellitus were the most prevalent chronic conditions among the participants. Concerning prior occupational injuries, over fifty percent of the surveyed workers indicated experiencing dermatitis.

This outcome aligns with **Ibrahim et al., (2019)** who investigated the "Effect of an educational program about OHS on knowledge, attitude, and practice of workers in a textile factory in Damietta city," noting that fewer than half of the

workers examined experienced skin issues. Conversely, this finding contradicts **Aly & Mohammed, (2018)** who explored "occupational hazards and quality of life among fertilizer factory workers in Assiut City" and found that over three-quarters of the workers reported headaches and respiratory ailments, while less than a quarter indicated skin problems and allergy symptoms.

The total knowledge score of the assessed workers (Figure 1) revealed that less than half of the participants had a satisfactory level of knowledge. Furthermore, one-third had an average degree of comprehension, while less than one-fifth shown a poor level of knowledge.

This result was inconsistent with the research of **Mahmoud & Abd El-Aziz (2021)** titled "Occupational Health Hazards among Workers in Ceramic Factories," which indicated that less than one-fifth of the examined workers had enough overall knowledge on occupational health hazards. This result contradicted the findings of **Mousa et al., (2024)** who indicated that over three-quarters of respondents were cognizant of the detrimental effects of pesticides on human health and the environment, and that knowledge regarding the impacts of agro-chemicals was relatively high.

The analysis of the investigated workers' practices concerning the use of PPE (**Table 4**) indicates that the majority indicated the availability and usage of breathing masks. The majority indicated the availability and use of safety footwear. Furthermore, the majority indicated the availability and use of protective face glass shields. Conversely, over two-fifths of the surveyed personnel indicated the availability of asbestos gloves and ear muffs, although did not use them.

This outcome aligned with the research conducted by **Asgedom et al.,**

(2019) titled "Knowledge, Attitude, and Practice Related to Chemical Hazards and PPE Among Particleboard Workers in Ethiopia," which indicated that approximately two-thirds of the surveyed workers utilized at least one form of PPE during their employment and acknowledged that the factory supplied PPE. This finding contradicts the study by **Abd El Rahman et al., (2022)** which examined "Occupational health hazards among workers in glass manufacturing industries" and revealed that two-fifths of workers do not use PPE.

The analysis of the investigated workers for environmental safety and sanitation (**Table 5**) revealed that the majority indicated the presence of a safe floor, devoid of projecting nails, holes, and splinters. Additionally, the majority indicated the availability of ambulances. Furthermore, the majority indicated the presence of emergency equipment at the health facility.

The findings were corroborated by the research conducted by **Aly & Mohammed, (2018)** which indicated that the overwhelming majority of workers reported the physician's constant presence in the plant. Furthermore, most employees saw the availability of nursing services inside the plant. However, this outcome was inconsistent with the findings of **Mahmoud & Abd El-Aziz, (2021)** who stated that fewer than three-quarters of workers indicated the existence of floor cracks and fissures.

Concerning the distribution of the examined workers based on their practices related to environmental safety and sanitation (**Table 5**), the present research revealed that the majority of the surveyed workers said that employee facilities were maintained in a clean and correct condition. The majority indicated the presence and functionality of point of operation guards on all operational equipment. Furthermore,

most of them said that materials are stored in an interlocking manner and restricted in height to ensure stability. This may be ascribed to the effective implementation of safety management techniques and rules within the manufacturing work environment.

This outcome aligned with the findings of **Ali & Zulkaple, (2023)** who indicated that employees also encountered problems associated with environmental elements and the state of their workstations. This outcome aligns with **Anbessie, (2019)** who examined "Assessment of OSH Management Practices: The Case of Chemical Industry Corporation" and found that staff facilities are consistently clean and well-maintained.

Concerning the relationship between the socio-demographic characteristics of the examined workers and their overall level of practice (**Table 6**), the present study revealed statistically significant differences associated with the workers' age, type of employment, and years of experience. No significant statistical link was found between the overall practice levels of the investigated workers and their educational attainment, marital status, training courses, or departmental affiliation.

This result aligns with the findings of **Abad-Elzahr et al., (2018)** who investigated "Workers' Knowledge and Practice About Occupational Hazards and Safety Measures in Bakeries at Assuit City" and revealed that there were no statistically significant differences between the educational and marital status of the workers studied and their utilization of safety measures. This result contradicted the findings of **Debela et al., (2023)** who investigated "OHS practices and associated factors among workers in Ethiopia's Metehara and Wonji sugar industries" and concluded that there was no statistically significant difference in the

relationship between the overall levels of practice among the studied workers and their work experience.

The current study demonstrated a statistically significant positive correlation between the total level of knowledge and the total level of practice among the studied workers (**Table 7**).

This result was similar to the findings of the research done by **Mohammed et al., (2022)** which indicated a statistically significant difference correlation between total knowledge and behaviors. This study's findings concur with those of **El-Ghany & Mahmoud, (2019)** who revealed a favorable correlation between total workers' knowledge and overall practice levels. This conclusion aligns with the findings of **Elsayed et al., (2023)** who demonstrated a highly statistically significant positive association between total awareness of occupational health risks and total activities linked to their prevention among the examined workers.

## Conclusion

**According to the outcomes of this study, it can be concluded that** there is a positive correlation between the total level of knowledge and the total level of practice with statistical significant association among the studied workers. Less than one fifth of the workers had a poor level of knowledge, while more than one-third had unfair knowledge, and less than half had a good level of knowledge. More than three-quarters of the workers had a satisfactory level of practice with using personal protective equipment, whereas less than one-quarter had an unsatisfactory level of practice.

## Recommendations

- Regular periodic screening for all workers for early detection of any health problems.

- Personal protective devices should be available to all workers in the Factory.
- Emphasizing on the importance and usefulness of personal protective equipment to be used in the right way and first aid for the promotion of personal fitness of the workers by health promotion programs.
- Future research about precautions of safety hazards.

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