

Occupational Hazards among Gas Station Workers

Asmaa S. ELSayed *, Hanaa A. Ahmed**, Hala M. Mohamed***

* Demonstrator of Community Health Nursing Faculty of Nursing, Ain Shams University

**Professor of Community Health Nursing Faculty of Nursing, Ain Shams University

*** Assist.Prof of Community Health Nursing Faculty of Nursing, Ain Shams University

Abstract

Background: Gas stations as work setting have hazards such as of chemicals substance and physical hazards which be potentially hazardous to environmental and human health. **Aim of the study** was to assess the occupational health hazards among gas station workers **Research design** :descriptive analytical design was used **Setting:** the study was conducted at 53 gas stations in Assuit governorate **Sample:** convenience sample include 260 gas station workers **Tools:** two tools were used for data collection, **1st tools:** interviewing questionnaire sheet for the workers divided into five parts: **part one:** socio-demographic characteristics and work characteristics, **part two:** workers medical history, **part three:** occupational health hazards exposure in the work place **part four:** gas station worker's health status assessment, **part five:** worker's knowledge about of occupational health hazards& work related preventive measures **2nd tools:** observational checklist for workers practice for work related preventive measures, and gas station work environment **Results:** the study revealed that one third of workers age was >30-40 years old, and majority of the workers Define Chemical hazards as hazard they expose in work place ,three quarters of the workers define inhalation of petroleum fumes as a cause of chemicals hazards . more than halve of the workers demonstrated exposure to occupational health hazards during work , three quarters of workers had un satisfactory practice regarding to safety measures (Personal Protective Equipment & The personal hygiene) . And less than half of gas stations had unsafe environment. **Conclusion:** the study concluded there was statistically significant relation between knowledge of gas station workers and their age, education level, monthly income. Although there was statistically significant relation between gas station worker's exposure to Occupational health hazard and their education level highly, There was statistically significant relation between worker's knowledge and their occupational hazard exposure and there was Negative correlation and significant between hazard exposure and the Working environment. **Recommendation:** the study recommended that educational program related to gas station's health hazards, safety measures should be conducted.

Key words: Gas station, Occupational hazards, Gasoline, preventive measure

Introduction

Petrol stations are busy places with lots of vehicle and pedestrian traffic.

They also store and dispense large amounts of hazardous substances, especially flammable substances such as petrol, diesel and liquefied petroleum gas (LPG). That's why it's very important to

have good systems and processes in place for making sure people stay healthy and safe (**Work safe, 2016**).

Although most workers may never face any serious adverse health effects from workspace exposures, all types of work have hazards. These hazards can have short – and long – term health consequences, and every effort must be made to prevent and control work-related illness and injury (**Lundy & Janes, 2016**).

The environment of gas stations exposes gas station attendants to innumerable risks and health hazards, which should be considered harmful to the health status of these workers. Among the risks are: contact with fuels and other chemical products, remaining close to fuel pumps, noise, heat, cold, risk of being run over, robbery, repetitive movements, standing for long hours, and work overload due to the different functions they perform (**Cezar-Vaz et al., 2012**).

Automobile service station workers are at high risk of benzene toxicity because they neither take protective measures to prevent inhalation of petroleum products nor undergo regular medical checkup. Individual variations depend on the age, physical activity, smoking, pre-existing medical condition of the exposed person, amount of adipose tissue, genetic variation in benzene-activating and detoxifying enzymes, DNA healing capacity, and several growth-regulatory soluble mediators (**Fayed et al., 2017**).

Occupational and environmental health nursing is the specialty practice that focuses on the promotion, prevention, and restoration of health within the context of a safe and healthy environment. It includes the prevention of adverse health effects from occupational and

environmental hazards. It provides for and delivers occupational and environmental health and safety services to workers, workers populations, and community groups. Occupational and environmental health nursing is an autonomous specialty, and nurses make independent nursing judgments in providing healthcare services (**Lundy & Janes, 2016**).

Several government agencies regulate benzene levels and exposures as mentioned in American cancer society, 2016:

The Occupational Safety & Health Administration (OSHA) is the federal agency responsible for health and safety regulations in most workplaces. OSHA limits exposure to benzene in the air in most workplaces to 1 ppm (part per million) during an average workday and a maximum of 5 ppm over any 15-minute period. When working at potentially higher exposure levels, OSHA requires employers to provide personal protective equipment such as respirators.

Benzene has been classified as a human carcinogen by the International Agency for Research on Cancer, National Toxicology Program Report on carcinogens and the American Conference of Governmental Industrial Hygienists. Epidemiological studies have shown the occurrence of acute and chronic leukemia (**Hosny et al., 2017**).

According to **Hosny et al., 2017** studies, Benzene risk perception at the studied sites revealed a lack in benzene risk management and the guidelines of OSHA beside the Egyptian laws for exposure control were not fulfilled all times, especially for benzene hazard communication, which was reflected as allow level of awareness

Recent studies showed significant hematological disorders, chromosomal aberrations as well as relatively high concentration of phenol in 24-hour urine samples due to exposure to benzene in chemical industry workers. Furthermore, blood disorders may lead to anemia and other diseases causing a significant reduction in working capacity and activity of workers, loss of working hours, and the increase in the costs of medical care of the affected workers (Mohamed et al., 2013).

Aim of the Study

Aim of this study is to assess Occupational health hazards among workers in gas station through:

1. Assessing the types of occupational health hazards in the gas station.
2. Assessing of the gas station worker's health status.
3. Assessing knowledge and safety practice of Gas Station Workers about occupational health hazards and safety measures.
4. Assessing the working environment of the gas station.

Research question

1. Is there a relation between socio demographic characteristics and knowledge and occupational health hazard?
2. Is there a relation between worker's knowledge about their practice toward safety measures and the occupational health hazards exposure?
3. What is the health status of gas station workers?
4. Is there a relation between working environment and hazards exposure?

Subjects and Methods

Research design:

Descriptive analytical design was used in order to identify occupational health hazards among gas station workers.

Technical design:

a) Setting:

This study was conducted at gas stations in Assuit governorate; which includes 106 gas station according to gas station directory of ministry of petroleum Egypt, the investigators were selected 50% of gas stations total number by simple random sample technique. Which represent 53 gas stations.

b) Sampling technique:

The total number of gas stations workers at 53 gas station was 480 workers and. convenience sample was selected from the pre mentioned setting, consisted of 260 workers were included in the research who working in morning shift, and the data collected through two days a week (Saturday & Sunday) and carrying out 6 months.

• Tool of data collection

-The Two tools were used for data collection:

First tool: An interviewing questionnaire sheet composed of (Q1-54) questions, in to five parts developed and modified by researcher based on the literature review and expert opinions, it was written in Arabic language and filled by the investigators to assess:

Part I: Socio- demographic characteristics & Work characteristics

of the gas station worker, which include: age, educational level, marital status, working years, work system, health insurance, periodic examination (Q1-17).

Part II: Medical history of gas station Workers: diseases, and health problems (Q18-22).

Part III: Assessment the occupational health hazards exposure in work place such as the types of occupational health hazards (Q23-25), types of physical hazards (Q26), types of chemical hazards (Q27), biological hazards (Q28-29), ergonomical hazards (Q30), Psychological hazards (Q31), the most occupational health hazards occurred in work place (Q32) occupational health hazards and its cause's (Q33-38).

Part IV: Health assessment sheet: was used and adopted from **Bellack (2002)** by Investigator to assess current and common health problem with the gas stations workers which the investigator assess the workers' health statuses systematically, including: skin condition, skeletal, respiratory system and others.

The scoring system

It contains 64 points by score 1 for yes and zero for no. The total score for health status was 64 points the responses of gas station workers regarding the assessment of health status were distributed by the number and percentage for every signs and symptoms.

Part V: Knowledge about the occupational health hazards & work related preventive measures and safety such as: (chemical, physical, biological, physiological) Hazards, the occurrence of occupational accidents, types of

protective clothes, the main causes of occupational health hazards (Q39-54).

The scoring system

The total score knowledge about the occupational health hazards and safety was 73 point, classified into: correct $\geq 50\%$ = (37-73) and incorrect $< 50\%$ = (0-36), each answer was given 1point for correct answer and zero for incorrect answer, the answer for each questions was classified into correct $\geq 50\%$ while incorrect $< 50\%$ according to each number (Q34-49).

Second tool: An observational checklist: which included:

A- Gas station workers practices for work related preventive measure & safety: adopted and modified from (Reynolds 2000) by the investigators. It included (wearing protective devices such as: apron, gloves, boot and the following of hygiene measures).

The Scoring system:

It contains 12 item by score 2 for yes and 1 for no and zero for not applicable the total score for work environment was (24) points classified into: satisfactory $\geq 50\%$ =(13-24) points and un satisfactory $< 60\%$ (0-12) points.

B- Environmental occupational checklist: which developed from: Safety and health inspection checklist sheet (**Bonnie, 1994**), which assessed occupational environment it included safety administration, fire protection, housekeeping and others.

The scoring system:

It contains (77) item by score 2 for yes, 1 for no and zero for not

applicable the total score for work environment was (154) points classified into: safety $\geq 60\%$ =(93-154) points and un safety $<60\%$ (0-92) points. It classified into 5 categories (such as Safety administration, Personal protective equipment, fire protection) for every each categories is divided into: safe $\geq 60\%$ and un safe $<60\%$ according to each number.

Pilot study

Pilot study: Pilot study was done on 10 gas stations, which included 26 workers.it was carried out to test the applicability of the developed tools, clarity of the included questions and practicability; identify the obstacles and problems that may be encountered with data collection; and estimate the average time needed to complete all the questionnaire and modifications based on, the finding of pilot study necessary modifications of the questionnaire were made for the final development of the study questionnaire form. The subjects of the pilot study were excluded from study sample.

Field work

The field work was carried out through 6 months started from first of January 2016 till the end of June 2016, the investigators visited pre mentioned setting two days every week (Saturday and Sunday) for collecting data from 260 workers and the investigator read the question and wait until workers complete the questionnaire for illiterate workers while workers who read and write took questionnaire and filled it by themselves. So, questionnaire took about 30 minute for illiterate workers and 15 minutes for literate workers, health assessment and worker practice were taken about 45 minutes for each workers to be fulfilled,

and for working environment was taken 40 minutes for each station.

Statistical design:

Data were analyzed using Statistical Program for Social Science (SPSS) version 20.0. Quantitative data were expressed as mean \pm standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Chi-square (X^2) test of significance was used in order to compare proportions between two qualitative parameters.

- Probability (P-value):

- P-value < 0.05 was considered significant.

- P-value < 0.001 was considered as highly significant.

- P-value > 0.05 was considered insignificant.

- Spearman's rank correlation coefficient (rs) was used to assess the degree of association between two sets of variables if one or both of them was skewed.

Results

Results showed in **Table (1)** that the mean age of gas station workers was 38.42 ± 9.22 years and 35.8% had secondary education, only 6.2% who had University education regarding marital status 54.6% were Married. As regard family member 63.1% who had family numbers 4-6, the worker's income mean

2098£ with SD \pm 503£, as 80.8% of the workers had insufficient income.

Table (2) illustrated that gas stations workers working Years mean was 9.29 ± 2.23 years, 21.2 % of the workers had daily working and 71.5% had Shift (12 hours and more) work time, 100.0% of gas station's workers refueling the cars in work place, 91.5% who taken a training in work field.

Table (3) revealed that 85.4% of gas station workers who exposed to dust, while 79.6% of gas station workers exposed to Inhalation of petroleum fumes. As 91.2% of the workers demonstrated exposure to germs and infectious diseases. As 64.6% of worker stated that the reason of exposure to germs and infectious diseases was working without using the PPE. While 95.8% of the worker demonstrated the mean cause of agronomical hazards is standing for a long time. 53.8% of gas station workers demonstrated to exposure to psychological stressors as they Forced to work at station for financial need, also 64.2% of gas station workers stated that chemical hazards is the most probable risks happen in work environment.

Figure (1): showed that 58.8 % of workers demonstrated exposure to occupational health hazards.

Table (4) displayed the workers' knowledge and showed that less than half of gas station workers 48.5% who answered correctly about the meaning of occupational hazards, and types of the psychological hazards, 21.5% of them

answered correctly about types of the biological risks and 69.2% of them answered correctly about how to Decreasing & shorten from the occupational hazards.

Table (5) showed that all gas station had a good lighting, and ventilation and safe emergency exits, while 64.15% were commitment to safety measures of PPE and fire protection.

Figure (2): shows that 43.4% of gas stations had unsafe environment.

Table (6) clarifies that there was highly statistically significant difference with p-value (<0.01) between the age, education level, marital status and monthly income of workers and their knowledge about occupational hazards and work related preventive measures.

Table (7) indicates that there was highly statistically significant difference with p-value (<0.01) between Marital status of the workers and their exposure to occupational hazard. This table also shows that there was statistically significant difference with p-value (<0.05) between education level and family members of the workers and their exposure to Occupational hazard.

Table (8) reveals that there statistically significant difference with p-value (<0.05) regarding worker's knowledge and their occupational hazard exposure

Table (9) show Negative correlation and significant between hazard exposure and the Working environment.

Table (1): Distribution of studied sample according to their socio-demographic characteristics (n=260)

Item	No.	%
------	-----	---

Item	No.	%
Age :		
20-30	93	35.8
>30-40	88	33.8
>40-50	59	22.7
>50	20	7.7
Mean±SD	38.42±9.22	
Educational level:		
Illiterate	6	2.3
Literate	22	8.5
Primary stage	51	19.6
Prep stage	72	27.7
Secondary stage	93	35.8
University stage	16	6.2
Marital status:		
Single	76	29.2
Married	142	54.6
Widow	22	8.5
Divorced	20	7.7
Family members:		
<3	35	13.5
4-6	164	63.1
≥7	61	23.5
Mean±SD	5±1	
Monthly income(in L.E):		
≤1500	37	14.2
>1500-2000	87	33.5
>2000-2500	66	25.4
>2500	70	26.9
Mean±SD	2098±503	
Other income		
No	54	20.8
Yes	206	79.2
income sufficiency		
No	210	80.8
Yes	50	19.2

Table (2): Distribution of studied sample according to their work characteristics (n=260)

Item	No.	%
working Years:		
<10 years	153	58.8
>10 years	107	41.2
Mean±SD	9.29±2.23	
Work system:		
Daily work	55	21.2
Night	19	7.3
Shift	186	71.5
*tasks in work setting		
Refueling cars	260	100.0
Changing motor oil	157	60.4
lubrication of the cars	161	61.9
Car cleaning	228	87.7
Customers reviewing	225	86.5
Changing tires	14	5.4
*Training course taken		
training course (n=238):		
The nature & risks of the work	144	55.4
Using work's machines	129	49.6
Using the PPE tools	132	50.8
Emergency situation & safety	115	44.2
Using First aids	14	5.4

*Responses are not mutually exclusive

Table (3): Distribution of studied sample according to the exposure to occupational health hazards in work place by each hazards types (n=260)

Item	No.	%
* Physical Hazards		
Noise	182	70.0
Dust	222	85.4
High temperature	211	81.2
Low temperature	164	63.1
*Chemical hazards		
Inhalation of petroleum fumes	207	79.6
Inhalation of car's fumes and gases	227	87.3
Skin contact	178	68.5
Eye contact	62	23.8
Exposure to biological hazards		
Yes	237	91.2
* Most common causes of biological hazards		
Working without using the PPE	168	64.6
Having meals during work	135	51.9
Neglecting the personal Hygiene	140	53.8
*Most common causes of Ergonomical hazards		
Stand for a long time	249	95.8
Body in constant motion in the same position	100	38.5
*Most common causes of psychological stressors		
Fatigue due to physical effort	126	48.5
Work due to financial needs	140	53.8
Ill-Treatment from customers	26	10.0
*Most probable hazards happen in work place		
Chemical hazards	167	64.2
Physical hazards	129	49.6
Ergonomical hazards	66	25.4
Fire accidents	63	24.2

*** Total item not mutually exclusive**

Figure (1): Distribution of studied sample according to total score of their exposure to occupational health hazards.

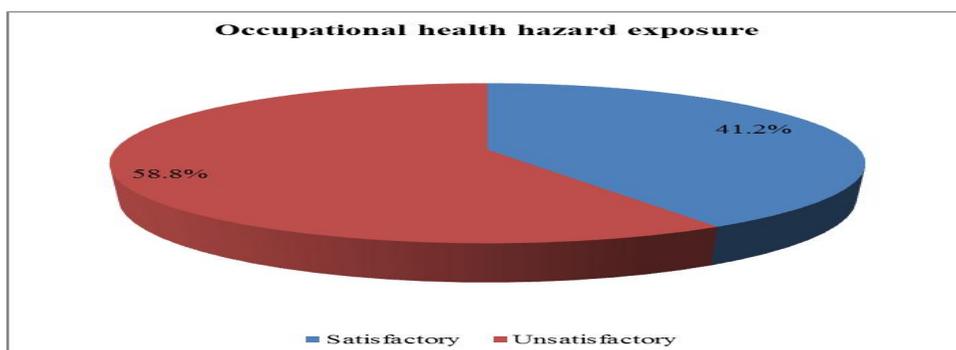


Table (4): Distribution of studied sample according to correct knowledge about the occupational health hazards (n=260).

Item	No.	%
meaning of occupational hazard	126	48.5
types of the occupational Hazards	151	58.1
types of the chemical risks	139	53.5
reasons of the biological risks (infectious diseases & germs)	148	56.9
types of the biological risks	56	21.5
types of the physical factors	132	50.8
types of the ergonomics hazards	111	42.7
types of the psychological hazards during work	126	48.5
Decreasing & shorten from the occupational hazards	180	69.2

Table (5): Distribution of Gas Stations according to environmental occupational checklist to assess occupational environment (n=53). (According to safety score level)

Environmental occupational checklist	Yes		No		N/A	
	No.	%	No.	%	No.	%
Safety administration	37	69.81	16	30.19	0	0.00
Personal protective equipment	34	64.15	19	35.85	0	0.00
Fire protection	34	64.15	10	18.87	9	16.98
Housekeeping administration	21	39.62	14	26.42	18	33.96
Workplace Inspection:						
Lighting	53	100.00	0	0.00	0	0.00
Ventilation	53	100.00	0	0.00	0	0.00
Housekeeping	36	67.92	17	32.08	0	0.00
Safety measures	53	100.00	0	0.00	0	0.00
Electric hazards protection	48	90.57	5	9.43	0	0.00
Materials handling and storage	49	92.45	4	7.55	0	0.00
Emergency douches (including eye douches)	11	20.8	16	30.2	26	49.1
Warning signs	45	84.91	8	15.09	0	0.00

Figure (2): Distribution gas stations according to total score level of environmental safety (n=53)

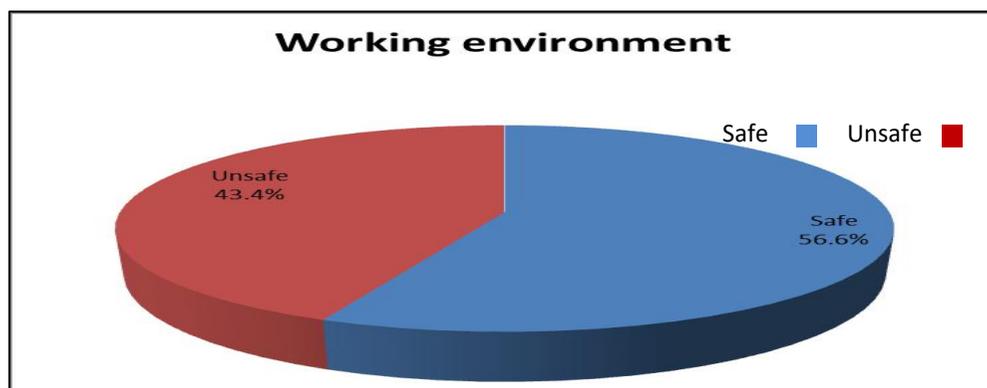


Table (6): Relation between socio-demographic characteristics of studied sample and their knowledge about occupational hazards (n=260)

Socio-demographic data	Total knowledge correct (N=224)		Incorrect (N=36)		Chi-square test	
	No.	%	No.	%	x2	p-value
Age (years)						
20-30	64	28.6	29	80.6	37.593	<0.001**
>30-40	82	36.6	6	16.7		
>40-50	58	25.9	1	2.8		
>50	20	8.9	0	0.0		
Education level						
Illiterate	6	2.7	0	0.0	44.361	<0.001**
Literate	22	9.8	0	0.0		
Primary stage	31	13.8	20	55.6		
Prep stage	71	31.7	1	2.8		
Secondary stage	78	34.8	15	41.7		
University stage	16	7.1	0	0.0		
Marital status						
Single	55	24.6	21	58.3	25.357	<0.001**
Married	133	59.4	9	25.0		
Widow	16	7.1	6	16.7		
Divorced	20	8.9	0	0.0		
Family members						
<3	27	12.1	8	22.2	4.944	0.084
4-6	147	65.6	17	47.2		
≥7	50	22.3	11	30.6		
Monthly income(in L.E)						
≤1500	21	9.4	16	44.4	31.920	<0.001**
>1500-2000	78	34.8	9	25.0		
>2000-2500	62	27.7	4	11.1		
>2500	63	28.1	7	19.4		

**Highly significant

Table (7): Relation between exposure of studied sample to Occupational hazard and their socio-demographic characteristic (n=260)

Socio-demographic data	Occupational hazard exposure				Chi-square test	
	Exposed (N=107)		Un Exposed (N=153)		x2	p-value
	No.	%	No.	%		
Age (years)						
20-30	30	28.0	63	41.2%	6.198	0.102
>30-40	42	39.3	46	30.1%		
>40-50	24	22.4	35	22.9%		
>50	11	10.3	9	5.9%		
Education level						
Illiterate	0	0.0	6	3.9	18.381	0.003*
Literate	11	10.3	11	7.2		
Primary stage	32	29.9	19	12.4		
Prep stage	22	20.6	50	32.7		
Secondary stage	36	33.6	57	37.3		
University stage	6	5.6	10	6.5		
Marital status						
Single	22	20.6	54	35.3	17.923	<0.001**
Married	62	57.9	80	52.3		
Widow	17	15.9	5	3.3		
Divorced	6	5.6	14	9.2		
Family members						
<3	14	13.1	21	13.7	13.875	0.002*
4-6	80	74.8	84	54.9		
≥7	13	12.1	48	31.4		
Monthly income (in L.E)						
≤1500	20	18.7	17	11.1	7.195	0.066
>1500-2000	32	29.9	55	35.9		
>2000-2500	21	19.6	45	29.4		
>2500	34	31.8	36	23.5		

* Significant, **Highly significant

Table (8): Relation between exposure of studied sample to occupational hazard and their total knowledge in work place (n=260).

Occupational hazard exposure	Total Knowledge				Chi-square test	
	correct (N=224)		Incorrect (N=36)		x2	p-value
	No.	%	No.	%		
Un Exposed (N=107)	85	37.9	22	61.1	5.949	0.015*
Exposed (N=153)	139	62.1	14	38.9		
Total	224	100.0	36	100.0		

* Significant, **Highly significant

Table (9): Correlation between exposure of studied sample to Occupational hazard and their Working environment (n=260)

Working environment	Occupational hazard exposure	
	R	p-value
	-0.482	<0.001**

* Significant, **Highly significant

Discussion

Occupational hazards may lead to illness, injury or death. They can include physical risk like falls and exposures to heavy machinery, along with psychological ones such as stress. Occupational hazards like exposure to chemical, biological and radiological agents are also concern. In people who work in jobs with recognized occupational safety hazards, special training is often provided so that the people are made aware of the hazards (**wise GEEK, 2013**).

In the light of scientific, local and international references, discussion of obtained results done, Regarding the personal data of the study sample, the present study showed that the mean age of gas station workers was 38.42 ± 9.22 years (**Table 1**).

This result came in agreement with the study conducted by **Cezar-Vaz et al. (2012)**, namely, risk perception and

occupational accidents: a study of gas station workers in southern Brazil, where the mean age of the study sample was 30.25 ± 9.58 years. Also, the current study's findings were supported by the study of **Rocha (2013)**, "the use of personal protective equipment by gas station workers: a nursing contribution", conducted in Rio Grande, RS, Brazil, which showed that the mean age of the studied sample was 30 ± 9.58 years. However, these results were in partial agreement with the study of **Abdel Monem et al. (2010)**, namely, exposure of gas station workers to leaded gasoline in the Gaza strip: awareness and self-reported symptoms, where the workers had a mean age 34.4 ± 10.7 years.

Regarding the educational level of the study sample, more than half of them did not continue their education post the preparatory stage, while more than a third of the sample had secondary education. Moreover, regarding the marital status of the study sample, more than half of them were married, and the number of family members for more than two thirds of

them was 4-6 members. In addition, the mean monthly income for the studied workers was 2098 ± 503 . Also, a majority of the workers had other sources of income (**Table 1**).

The current study described that the mean years of experience in the studied gas station workers were 9.29 ± 2.23 , also more than half of the sample had less than 10 years of experience, and most of them worked in shifts only and for more than 12 hours.

These results came in disagreement with those of **Rocha (2013)**, where the workers had experience more than 10 years. Also, there was a conflict with the results of the study by **Tunsaringkarn et al. (2012)**, conducted in Bangkok, Thailand concerning the occupational exposure of gas station workers to BTEX compounds in Bangkok, Thailand, where the mean experience of the workers was 2.9 ± 2.5 years, with a work shift duration of 9.9 ± 1.8 hours.

However, the study of **Abdel Monem et al. (2010)**, came in partial agreement with the current study, as it reported that most of the workers were married; more than a third of them finished high school, while less than a quarter of them finished prep school. However, there was a disagreement regarding the years of experience for the studied workers in both studies.

Regarding the work characteristics in the current study, more than half of the study sample had less than 10 years of experience, also more than one fifth of them were daily workers, while most of the sample worked in shifts (8-12 hours or more, at day or night) (**Table 2**). These results were inconsistent with those of the study conducted by **Abd El Aziz and Abd-El Aal (2012)**, namely, occupational

program for improving the health of gasoline workers in Benha, where nearly two thirds of the study sample were daily workers, and the same fraction of the sample worked 6-12 hours/day.

These outcomes were in agreement with the results of **Alam et al. (2014)**, in the study about lung function abnormalities among fuel filling workers in Karachi, Pakistan, where most of the studied workers who lived in the working establishment spent more than 12 hour-shifts.

Regarding the tasks performed, the present study reported that all the studied workers were tasked to fuel cars (**Table 2**), these finding came in agreement with the study conducted by **Rocha (2013)**, who reported that all the workers had the responsibility of fueling cars. Furthermore, the current study reflected that three fifths of the gas station workers were in charge of changing motor oil and lubrication of the cars, while the majority had car cleaning duty. However, **Rocha (2013)** reported that more than a quarter of the workers had the task of changing motor oil, and a minimal percentage of them had the task of cars' lubrication and cleaning, Regarding attending training courses, the current study showed that the majority of the study sample attended training courses, and half of them had training regarding personal protective equipment (PPE) (**Table 2**). These findings disagreed with those from the study conducted by **Abd El Aziz and Abd-El Aal (2012)**, where more than two thirds of the studied workers did not attend any training programs.

Furthermore, the present study showed that more than two thirds of the study sample reported exposure to noise as a physical hazard (**Table 3**). This was in agreement with the study conducted by

Pommerehn et al. (2016), namely, noise and quality of life in the perspective of gas station workers, where the majority reported exposure to noise, from traffic (horn sounds, engines, car exhausts without maintenance) and work equipment (fuel dispensers and car washing and tire inflation machines, telephone, and radio).

Another risk reported by the studied workers in the present study was inhalation of petroleum fumes (reported by more than three quarters) and exposure to car exhaust gases (reported by the majority) (**Table 3**). These reports were supported by the study results of **Cezar-Vaz et al. (2012)**, who reported that more than three quarters of the gas station workers were exposed to fuel inhalation, and more than three fifths of them were exposed to other gases.

The study also revealed that two thirds declared spills of petroleum products on clothes and skin, and less than a quarter of the sample described palpation of petroleum products to the eye, while contact with the oral mucosa was reported by a minimal fraction, also more than a tenth reported contact with the nasal mucous membranes (**Table 3**).

The study of **Cezar-Vaz et al. (2012)** came in disagreement with these findings, where skin contact with fuel (gasoline, alcohol, diesel) was reported by the majority of the sample, skin contact with fuel (gasoline, diesel) was reported by nearly two thirds of the study sample, eye contact with fuel (gasoline, alcohol, diesel) was reported by nearly three quarters of the workers, and eye contact with other substances (detergent, grease, dust) was described by a little more than half of the studied workers.

These findings reflected the fatal effects of long term exposure to benzene and spending a long time in this kind of working environment in addition to the consequences of such actions on the worker's health.

Furthermore, regarding exposure to physical hazards, the present study pointed out that less than three quarters of the workers reported exposure to noise, while the majority indicated exposure to dust, however exposure to vibrations was reported by a minimal fraction of the sample, also high temperature was reported by more than four fifths of the studied sample, while low temperature was reported by less than two thirds of them (**Table 3**).

However, the study of **Cezar-Vaz et al. (2012)** pointed out that regarding exposure to physical hazards, more than half of the workers reported noise and heat, less than three quarters of the sample reported the cold, and more than one fifth of them reported vibrations. These findings could be attributed to the conditions of a gas station as a working environment, being an open place, and consequently very hot in the summer and very cold in the winter.

Moreover, regarding the biological hazards, the current study reported that most of the studied workers accepted that working in a gas station exposed them to biological hazards, the reasons for such hazards were reported by more than two thirds of the sample to be due to working without using the personal protection tools, while less than half the workers reported dealing with a lot of frequent clients to be the reason, and more than half of the study sample described having meals during work to be the cause for such hazards, and more than half reported

neglecting personal hygiene to be the reason (Table 3).

These findings were in partial agreement with the study results of **Cezar-Vaz et al. (2012)**, who reported that nearly two thirds of the workers identified the biological hazards to which they were exposed in their working environment, and indicated that the main contaminating microorganisms were bacteria and viruses, which could be transmitted by frequent contact with customers, inappropriate hygiene conditions in the work environment, and insufficient individual protection measures. These findings highlighted the importance of using PPE by the gas station workers while dealing with clients, especially during long busy shifts.

These results were in agreement with those of **Abdel Monem et al. (2010)**, where the workers reported using protective measures during work, not smoking during work, and not eating during work.

Figure (1): showed that more than half of the studied workers demonstrated exposure to occupational health hazards. **Abd El Aziz and Abd-El Aal (2012)**, pointed out that these problems could be due workers' exposure to smoke-polluted air for long time periods due to the work environment, which can cause systematic problems. **Ahmed et al. (2012)**, indicated that the continuous operation of gas stations poses various hazards to people and environment.

The present study showed that less than half of the study sample knew the meaning of occupational hazards, more than half of them knew the types of chemical hazards, more than two fifths identified agronomical hazards, more than

one fifth reported biological hazards, more than half of the workers were able to describe physical hazards and less than half of them defined psychosocial factors (Table 4).

These results were in disagreement with the study of **Faith Eyayo (2014)**, where the majority of the study sample were able to identify the physical and mechanical/ergonomic health hazards, followed by those who could identify chemical health hazards, while only the lowest fraction was able to describe biological health hazards. These findings indicated that the studied workers needed more education regarding occupational hazards.

Regarding the safety and administration of the working environment (Table 5), the present study showed that all gas stations had an identified person in charge of safety and administration, also the majority of the workers were trained, and most of the gas stations had regular updated records. In addition, less than half of the workers did not have PPE available for all hazards, and more than one third of gas stations' PPE were not in enough numbers relative for the workforce. Moreover, more than half of the gas stations had applicable training programs for the workers.

In addition, most of the gas stations had identifiable persons in charge for fire control. Also, all of the gas stations trained the workers to deal with fire accidents. Furthermore, more than four fifths of the gas stations had availability of regular updated records.

All the gas stations had available, operable, and clearly-marked fire extinguishers. Also, all the gas stations had an identifiable person in charge for housekeeping, despite one fifth of the

stations had written housekeeping policies and procedures. Moreover, more than two thirds of the gas stations' working areas were clean with no spills, while more than one third of the working areas were not orderly arranged.

Furthermore, all the gas stations' forecourts had clear passageways with no obstructions, while only one fifth had holes in the ground. Also, all the gas stations had clearly marked enough exits relative for the workforce, and in most of the stations, there were storage areas, which were locked in more than two thirds of the gas stations. Moreover, all the stations had warning signs for safety instructions, which were understandable, more than third of gas stations had not warning signs in all worksites.

These results were in consistence with the study of **Nouri (2009)**, namely, risk assessment and crisis management in gas stations, in Tehran, where, in agreement with our study, the majority of the gas stations had desirable exit ways, most of the personnel of the gas stations were trained in extinguishing fires, manual extinguishing systems were of a good quantity and quality, however their arrangements were not desirable, also electrical networks were perfect and did not need any further correction, and alarming signs were adequately used in the majority of the stations, which indicated the presence of proper safety education among the managers and owners of these stations.

However, the disagreements with the present study included a fraction of the stations which were not in a good condition and were not isolated by reinforced concrete, also, the majority of the stations were not equipped with proper automatic alarming and extinguishing systems.

Furthermore, the results shown in the current study were consistent with those from the study conducted by **Abd El Aziz and Abd-El Aal (2012)**, where the majority of the gas stations had average cleanliness, while two fifths of them had good fire prevention measures, however the disagreement with the present study lies in the absence of posters for prevention of hazards. It should be noted that the lack of control measure at the work place could expose workers to risks of gasoline hazards.

The result of the study by **James (2012)**, namely, safety and health assessment in Kenyan petroleum station, were in partial agreement with the current study regarding fire safety, the adoption of prevention measures, appropriate installation of firefighting measures, and presence of warning signs conspicuous enough to draw attention. Also, more than half the studied stations had proper housekeeping scores and less than three quarters of the stations had suitable and trained workers. Moreover, regarding health and safety issues like the availability of training manuals, the safety and emergency procedures, and the presence of authorized firefighting personnel trained in first aid, the majority of gas stations scored >70%. These findings referred to regular conduction and observation followed primarily in construction of gas stations before acquiring operational approvals.

Figure (2): showed that more than two fifths of the gas stations were unsafe working environments. Along the same lines, **Abd El Aziz and Abd-El Aal (2012)** reported that regarding safe occupational environments, the majority of gas stations had average cleanliness, while two fifths had good fire prevention measures, like the presence of fire

extinguishers. Also, all the gas stations had no posters for prevention of hazards.

The current study revealed a statistically significant association between the knowledge of gas station workers and their age, educational level, and marital status (**Table 6**). These results disagreed with those of **Abdel Monem et al. (2010)**, who showed that the knowledge of workers regarding the effects of leaded gasoline on human health and the environment was high. However, the workers' education had no significant influence on their knowledge. This was supported by **Abd El Aziz and Abd-El Aal (2012)**, who stated that there was no significant relation regarding the knowledge of workers and their education.

The current study also stated the presence of a statistically significant association between gas station workers' demonstration of relevant occupational health hazard exposure and their education level, marital status and family size (**Table 7**).

However, there was no statistically significant relation between age, monthly income, other materialistic resources and income sufficiency.

This came in disagreement with **Abd El Aziz and Abd-El Aal (2012)**, where nearly two fifths of the workers with intermediate education had poor knowledge regarding gasoline and GIT problems.

On the other hand, there was a statistically significant relation between workers' total knowledge and their exposure to occupational health hazards **Table (8)**.

These results were in an agreement with those of **Rocha (2013)**, and supported by **Grendel et al. (2009)**, who reported a significant association between work activity and time of exposure to harmful

substances and knowledge concerning such harm. Along the same lines, **Soares et al. (2011)** described that there was a need to clarify the work activity and time of exposure to harmful substances because the population usually does not have knowledge concerning such harm or neglects it, also when the workers realize their own exposure to occupational risks, they become co-responsible in the prevention of diseases and accidents and in health promotion.

Furthermore, the study illustrated a negative significant correlation between hazard exposure and the working environment (**Table 9**). This was in agreement with **Tunsaringkarn et al. (2012)**, and supported by **Wiwanitkit et al. (2008)**, where it was shown that benzene exposure mostly was associated with headaches, however, in this study benzene and toluene exposures were significantly associated with fatigue.

Moreover, these findings came in agreement with **Monney et al. (2015)**, who showed that there was a significant association between exposure to hazardous materials and the working environment, as apart from the exposure to extreme weather conditions, the inhalation of fumes from vehicles and petroleum vapor by pump attendants, as reported by the majority of the study subjects, also posed grave health risks.

Conclusion

On the light of the finding of the present study, it can be concluded that that:

There was a significant relation between the knowledge of gas station workers and their age, education level, and monthly income. Also, there was a significant relation regarding workers'

knowledge and their occupational exposure to health hazards. The study further illustrated that there was a significant relation between the knowledge of the studied sample and their work practices related to preventive measures.

Also, there was a significant relation between gas station workers' exposure to hazards and their working environment. This reflected a significant relation between workers' work practices related to preventive measure and their work characteristics.

Recommendations

Based on the finding of the present study, suggested the following recommendation:

1. All the workers in gas stations should be included in the health insurance organization.

2. Periodic health examinations and scheduled medical surveillance should be implemented for each gas station worker.

3. Practical training for gas station workers (work related activities with using of Personal Protective Equipment, how to handle fuel leakage, how to deal with emergency situations in case of fire or injury, etc.)

4. A written list must be available about all hazardous substances used in the work place, with each substance product identity.

5. Periodic inspection of gas station working environment.

References:

Abd El Aziz M. & Abd-El Aal E. (2012): Journal of American Science; 8(7), Occupational Program for Improving the Health of Gasoline Workers J Am Sci; 8(7): 33-41.

Abdel Monem, H., Lubbad, L., Adnan, I. Al-Hindi, Abed Al-Rahman I. Hamad and Yassin M., (2010): Exposure of gasoline station workers to leaded gasoline in the Gaza strip: Awareness and self-reported symptoms. Annals of Alquds Medicine, (6)

Ahmed, M.M., Kutty, S.R.M., Khamidi, M.F., Othman, I., Shariff, A.M. (2012): Hazard Contributing Factors Classification for Petrol Fuel Station, World Academy of Science, Engineering and Technology, International Science Index: 6(12): 2012 waset.org/Publication.

American Cancer Society (2016): Inc Benzene and Cancer Risk, <http://www.cancer.org/cancer/cancercauses/othercarcinogens/intheworkplace/benzene>

Cezar-Vaz, M.R., Rocha, L.P., Bonow, C.A., Silva, M.R.S., Cezar-Vaz, J., Cardoso, L.S. (2012): Risk perception and occupational accidents: a study of gas station workers in southern Brazil. Int J Environ Res Public Health; 9(7):2362-77.

Faith Eyayo, (2014): Evaluation of Occupational Health Hazards among Oil Industry Workers: A Case Study of Refinery Workers. OSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)e-ISSN: 2319-2402,p-ISSN:

2319-2399. 8(12): Ver. I (Dec. 2014),
PP 22-53.

- Fayed H M, Aly S S, Saleh S M, Ahmed A, (2017):** Phenotype analysis of lymphocytes in workers with chronic benzene exposure, Department of Clinical and Chemical Pathology, Faculty of Medicine, South Valley University, Qena University Hospital, Qena, Egypt, Volume: 42, Issue: 4, pp161-168, [http:// www.ehj.eg.net/article.aspissn](http://www.ehj.eg.net/article.aspissn)
- Ferreira, M.C., Freire, O.N., Carga de Trabalho E (2001):** Rotatividade na Função de Frentista. RAC; 5: 175–200.
- Grendel GL, Teixeira M L. (2009):** Avaliação de ácido hipúrico como biomarcador de exposição ocupacional em trabalhadores de postos de combustíveis. Rev Saúde Pesquisa.; 2(3):319-24.
- Habeck M., (2010):** Benzene, available at <http://www.eco-usa.net/index.shtml>
- Hambach, R., Mairiaux, P., Francois, G., Braeckman, L., Balsat, A., Hal, G.V. (2011):** Workers' perception of chemical risks: A focus group study. Risk Anal; 31:335–342.
- Hosny G, Elghayish M, Noweir K, (2017):** Health risk assessment for benzene-exposure in oil refineries, University of Alexandria, Egypt, International Journal of Environmental Science and Toxicology Research Vol. 5(1) pp. 23-30, February, 2017, Available online <http://www.internationalinventjournals.org/journals/IJESTR> Copyright ©2017 International Invention Journals
- Isaac Monney, John Bosco Dramani, Abigail Aruna, Asantewa Gyamfi Tenkorang, Fred Osei-Poku (2015):** Health and safety in high risk work environments: A study of fuel service stations in Ghana. Journal of Environmental and Occupational Science, www.jenvos.com
- James M , Fedha IM (2012):** Safety and health assessment in Kenya petrol station: case study of Thika Nairobi high way, ISSN2079-6226, Proceeding of the 2012 mechanical engineering conference on sustainable research and innovation volume 4, 3rd- 4th may 2012
- Kaufman, D.W., Anderson, T.E., Issaragrisil, S, (2009):** Risk factors for leukemia in Thailand. Ann. Hematol; 88, 1079–1088. 18.
- Lundy, K.S., & Janes, S. (2016):** Community health nursing ,caring for the public's health, 3^{ed}. Jones & Bartlett learning books, chapter 38 occupational health nursing ,PP1100-1125. www.jblearning.com.
- Mohamed EI, Khalil GI, Abdel-Mageed SM, Bayoumi AM, Ramadan HS, Kotb MA (2013):** Electronic noses for monitoring benzene occupational exposure in biological samples of Egyptian workers. Int J Occup Med Environ Health 26(1):165-72.
- Nouri, J., Omidvari, M., Tehrani, S.M. (2009):** Risk Assessment and Crisis Management in Gas Stations, Corresponding author E-mail: manouchehromidvari@yahoo.com,. Int. J. Environ. Res., 4(1):143-152

- Ontario Ministry of Labour (2013):** <https://www.labour.gov.on.ca/english/hs/faqs/hazards.php>
- Rocha LP, Vaz-Cezar MR, Bonow CA, Costa Z, (2013):** Use of personal protective equipment by gas stations workers: a nursing contribution: laurelize@gmail.com, 1Extracted from the thesis - Gas stations workers: individuals exposed to benzene, Nursing Graduate Program, Federal University of Rio Grande (FURG), 2012.
- Rutaba Alam, Amsa Zafar, Asmara Ghafoor, Aiman Naseem, Quratulain Ali & Prof. Fauzia Imtiaz, (2014):** Lung function abnormalities among fuel filling workers in Karachi, Pakistan, <http://www.pjpub.org>. Pinnacle Environmental & Earth Sciences, Vol. 1 (1) 2014, Article ID pees_128, 183-187,
- Tunsaringkarn, T., Siriwong, W., Rungsiyothin, A., Nopparatbundit, S. (2012):** Occupational exposure of gasoline station workers to BTEX compounds in Bangkok, Thailand. The International Journal of Occupational and Environmental Medicine; 3:117-25. www.thejjoem.com Vol 3 Number 3; July, 2012
- WiseGEEK. (2013):** Available at: <http://www.wisegeek.com/what-are-occupational-hazards.htm>.
- Wiwanitkit V. (2008):** Headaches in subjects occupationally exposed to benzene vapors. J Headache Pain; 9:253-4.
- Wiwanitkit, V., Suwansaksri, J., Nasuan, P. (2001):** Research note: Urine trans, trans-muconic acid as a biomarker for benzene exposure in gas station attendants in Bangkok, Thailand. Ann. Clin. Lab. Sci, 31, 399-401
- Work Safe (2016):** Petrol station Available at: <http://www.worksafe.govt.nz/work-safe/industry-petrol-station.html>
- World Health Organization (2012):** Overview of Occupational Health Services, WHO Regional Publications, European series No.26. Copenhagen, pp243-254.