# Workers' Safety Practices regarding Occupational Health Hazards at Butane Gas Tube Packing Plant Factory

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## Abstract

**Background:** The promotion of safety among liquid petroleum gas workers is one of the key aims of world liquid petroleum gas association, safety measures are important action to protect, maintain and promote the health,. **Aim:** to assess the safety practice of workers about occupational hazards in butane gas tubes packing plant factory in Akhmim city at Sohag governorate. **design:** Descriptive design was carried out. **Setting:** In the factory of butane gas tubes packing plant factory in Akhmim city at Sohag Governorate. **Sample:** All number of the workers was chosen to carry out the study. **Tools:** Two tools were used for data collection. **Tool (I)** divided into two parts; part (1): personal data of the subject, part (2): medical history. **Tool (II)** divided into two parts, part (1) An observational checklist that included preventive measure & safety practice**,** part (2) environmental checklist**. Results:** The study results showed that 60.4 % of the studied workers had a medical history.Also, revealed that 62.2% of the studied workers incompetent with the safety practice and preventive measures, 64.4% of them were in a safe environmental workplace. **Conclusion:** The workers had unsatisfactory report about safety practice and preventive measures, the studied workers were in a safe environmental workplace So, most of them were exposed to the occupational health hazards. **Recommendation:** Training and educational program about the preventive measure in the factory to eliminate the hazards in workplace

**Keywords: preventive measures, Packing plant factory Safety practice, and workers in butane gas tubes**.

## Introduction

Gas industry makes a significant contribution to the global economy and its growth and development in the worldwide, the gas industry alone accounts for almost 3 percent of global domestic product, the trade in crude gas reached 640 billion US in 2020, making it one of the world most traded commodities. **(International labor organization, 2022).**

Workers in gas industries are exposed to various health hazards as a result on nature of work such as vehicle collision that workers and equipment are required to be transported to and from sites, in addition explosions and fires resulting from flammable gases such as well gases, vapor's, and hydrogen sulphide which can be releases causing fire and explosion, falls that resulting from working in high levels, ergonomic hazards causing injuries as a result of lifting heavy items, bending, pushing and pulling heavy workloads and performing the same task repetitively, furthermore electrical and machine hazards**.(International labor organization,2020).**

The promotion of safety among liquid petroleum gas workers is one of the key aims of world liquid petroleum gas association, safety measures are important action to protect, maintain and promote the health, safety and wellbeing of their workforce both within and outside of the work environment, using of personal protective equipment is very important to minimize exposure to the health hazards in workplace, this PPE such as boots, apron, gloves, mask, goggles, earplugs and uniform in gas industry that is suitable for constant use of this device, other safety measures including knowledge of fire triangle, use of fire extinguisher, cylinder safety, workers and workplace related safety**.(Joshua et al., 2020).**

Occupational health nurses play an important role in preventing occupational hazards, industrial hazards, through determining the workers' health problems, identifying the industrial health hazards and dangerous conditions, plan and promote workers health by providing appropriate treatment, the occupational health nurse also participate in implementing a safety plan to prevent accidents and injuries that occur during daily activities, assesses worker's needs, develop educational program by using formal and informal presentation, using preventive measures during working, encourage workers to use health services, evaluate effectiveness of workers response to nursing action and control the environmental factor that cause disease.(**Nour-Eldien et al., 2022)**.

## Significance of the Study

The International Labor Organization **(ILO)** estimates that each year , over 300 million non-fetal accidents and over 2 million fatalities are caused by work related accidents and diseases, every day, more than 6000 are killed and over 800.000 peoples are injured, in sub – Saharan African countries, about 54.000 fetal occupational accidents occur each year with about 42 million job- related incidents resulting in at least 3 days off work.**(Mengesha Y et al., 2023).**

The World Health Organization and the International Labor Organization estimate that over 10 million people are killed and injured in work-related accidents each year, and that approximately 59 million workers in the gas sector are exposed to occupational dangers on a daily basis. These people were apparently shown to be more vulnerable to hazardous situations. .**(Mengesha et al., 2023).**

**While in Egypt; According to the central agency of public mobilization and statistics 2021,** the prevalence of workplace injury in factories is 19.3% from total injury, the largest number of workplace injuries in 2020 according to causes was as following: 29% resulting from falls, 22.9% resulting from errors and collision with objects and 0.2%resulting from explosions. **(The central agency of public mobilization and statistics (CAPMAS), 2021)**.

## Aim of the study

To assess workers' safety practices regarding occupational health hazards at butane gas tube packing plant factory in akhmim city in the sohag governorate.

## Research questions

- What are the workers' safety practices regarding occupational health hazards at a butane gas tubes packing plant factory?

## Subjects and Method

### Research design

Descriptive research design was used in this study.

### Setting

This study was conducted at the factory of butane gas tubes packing plant factory in Akhmim city at the Sohag Governorate.

The factory refills about 25000 cylinders daily to the consumers in all sohag cities and villages that consists of two buildings (administrative and refilling building), the refilling building contains one floors but the administrative building contains three floors

### Sample

A total coverage of workers were used. The total number of workers in butane gas tubes packing plant factory in Akhmim city in sohage governorate in this study was five hundred workers (500 workers ).

### Tools of the study

**Two tools will be used for data collection after reviewing the recent literature:**

**First tool**: **An interviewing questionnaire sheet composed of two parts** it modified by the researchers after reviewing the recent literature.

**Part I**: **personal data of workers.**

Which included: age, educational level, marital status, working years, work system, health insurance, periodic examination.

**Part II**: **Medical history which included**: diabetes, hypertension, heart disease, renal disease and follow up for medical examination.

**Second tool: An observational checklist that included two parts:**

**Part1: preventive measure & safety practice**: it adopted and modified from (Reynolds 2000), to assess preventive measure and safety practice of workers. It includes (wearing protective devices such as: apron, gloves, boot and the following of hygiene measures as are they changing clothing at the end and at beginning of shift?, are they wash their hands, face and leg periodically?).

**scoring system:** It included (11) items on workers' practices regarding health hazards of butane gas packing plant factory workers. Each done action was given (2 point), not done was given (1 point). The total score ranged from 11-22, score of each item summed up and then converted into percent score it was categorized as following:

- Incompetent practice <75% (nearly <17 point) of total practice.
- Competent practice ≥75% (nearly ≥17 point) of total practice score.

**Part2:Assessment of occupational Environment checklist**: which it was developed from: safety and health inspection checklist sheet (Bonnie, 1994) to assess occupational environment included: Safety administration which included (7 items): as existence of safety department, identified person in charge, written safety policy procedure, availability of trained personnel, availability of appropriate equipment, environmental measurement regularly done, availability of regular updated record.

**Scoring system:** It contains (65) item by score 2 for yes, 1 for no and zero for not applicable the total score for work environment was (130) points classified into: safety ≥ 60% =(78-130) points and un safety <60%(0-77) points. It classified into 5 categories (such as safety administration,

housekeeping administration, fire protection, workplace inspection, personal protective equipment) for every each categories is divided into: safe ≥ 60% and unsafe <60% according to each number **(Elsayed et al., 2018).**

## Validity

The face validity of the tool was reviewed by five (7) experts in community health nursing, Assiut University to evaluate the validity of the tools. Every member was asked to review the tool content and its structural design to ascertain, completeness and clarity of the items of questions. All comments and suggestions were considered and reworded and sequence of some statements was carried out accordingly.

## Reliability

The reliability of the tools was assessed using the Cronbach alpha test.

***Alpha Cronbach reliability analysis of the used tools:***

| Tools | No. of items | Cronbach Alpha Test |
|---|---|---|
| Practice | 11 | 0.793 |
| Environmental | 65 | 0. 759 |

## Administrative phase

An official letter of approval was obtained from the Dean of the faculty of nursing at Sohag University to director of butane gas tubes packing plant factory in Akhmim city at Sohag Governorate, this letter included permission to carry out the study after explaining the purpose and the nature of the study

## Pilot study

A pilot study was carried out on ten percent **(10 %)** of workers in factory to test the clarity of the sheet and estimate the time needed for filling the sheet. According to the result of a pilot study and the opinion of experts, the necessary modification was done in the clarity and sequence of some questions the pilot study was included in the study.

## Data collection phase

## Ethical considerations

Research proposal was approved by the Ethical Committee in the Faculty of Nursing, there was no risk for the study subject's further application of the research, the study followed common ethical principles in clinical research, informal consent was obtained from workers in butane gas tube packing plant who were willing to participate in the study, after explaining the nature and purpose of the study, Study subjects was assured that the data of this research will not be reused without second permission, confidentiality and anonymity was assured, study subjects had the right to refuse to participate and or withdraw from the study without any rationale at any time

## Field of work

After receiving official approval to conduct the study from the minister of the Ministry of Petroleum to the administrator of the butane gas packing plant factory at Sohag Governorate, along with a brief explanation of the study's purpose, data collection for this study took place over the course of four months, from the beginning of January to the beginning of April 2024. Following permission, the factory administrator was informed of the study's goal in order to win their cooperation.

Data was gathered from the butane gas tubes packing plant factory workers during their breaks and leisure time by the investigator who visited the workplace twice a week on Tuesdays and Wednesdays from 9:00 a.m. to 2:00 p.m. at factory official time. Additionally, the investigator visited the workplace most days between 3 and 7 p.m. to gather information from the night shift workers. Every day, the investigator interviewed with 15–16 workers.

## Statistical Analysis

Data entry and data analysis were done using statistical package for the social science (SPSS) version 26. Data were presented as number, percentage means and standard deviation. Chi-square test was used to show relation between variables. P-value considered statistically significant when $p < 0.05$.

## Results

**Table (1):** explains that 54.4% of the workers in the study were between the ages of 41 and 50 (mean ± SD of 34.2 ± 6.45), and 3% were between the ages of 20 and 30. Of these, 34.4% had only a basic education, while 21% had a university degree. Furthermore, it was found that 93.8% of the workers in the study had undergone a pre-employment examination, 82.4% had completed a training course, and 72.8% had taken an occupational safety course. The majority of the workers (96.8%) also reported having a health clinic at work, and 82.6% of them stated that the first aid services offered by the factory's health clinic were first aids.

**Table (2):** indicates that 60.4 % of the studied workers had a medical history, where 80.8% of them had the disease after working in factory and 19.2% of them had the disease before working in factory, indeed, 60.3% of them had a hypertension disease

before the employment. While, 10.2% of them had a musculoskeletal disease after the employment. It was noted that, 47% of them had a disease science 1<5 years. Additionally 81% were taking a medication regularly for specific disease.

**Figure (1):** clarifies that 62.2% of the workers were found to be incapable of following work environment procedures and preventative measures.

**Figure (2):** illustrates that 64.4% of the studied workers were in a safe environmental workplace.

**Table (3):** clarifies that there were a highly statistical significant difference between age , marital status, year of experience, receive a training course related to work, and total practices regarding occupational hazards P-value= (0.001, 0.001,0.001. 0.001) respectively, there were no statistical significant different between level of education and total practices regarding occupational hazards (P value = 0.338).

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## Results

***Table 1: Distribution of the studied workers according to their personal data (n=500):***

| Personal data | No. | % |
|---|---|---|
| **Age in years** | | |
| • 20 - <30 | 15 | 3.0 |
| • 30 - <40 | 121 | 24.2 |
| • 40 - <50 | 272 | 54.4 |
| • 50 – 60 | 92 | 18.4 |
| **(mean±SD)** | **34.2±6.45** | |
| **Level of education:** | | |
| • Read and write | 39 | 7.8 |
| • Basic education | 172 | 34.4 |
| • Secondary school | 184 | 36.8 |
| • University education | 105 | 21.0 |
| **Area of residence:** | | |
| • Rural | 395 | 79.0 |
| • Urban | 205 | 21.0 |
| **Are taking a regular periodic examination?** | | |
| • Yes | 380 | 76.0 |
| • No | 30 | 6.0 |
| • If necessary | 90 | 18.0 |
| **Attending any training course?** | | |
| • Yes | 412 | 82.4 |
| • No | 88 | 17.6 |
| **Types of course taking:** | | |
| • Occupational safety | 322 | 78.2 |
| • First aids | 240 | 58.3 |
| • Maintenance course | 72 | 17.3 |
| **Presence of health clinics or health services in the factory?** | | |
| • Yes | 484 | 96.8 |
| • No | 16 | 3.2 |
| **Types of the health services that provided in the factory:** | | |
| • First aids | 400 | 82.6 |
| • Health education | 13 | 2.7 |
| • Providing some medications | 71 | 14.7 |

***Table (2): Distribution of the studied workers according to their medical history (n=500):***

| Medical history | No. | % |
|---|---|---|
| **Have any medical history?** | | |
| • Yes | 302 | 60.4 |
| • No | 198 | 39.6 |
| **If yes?** | | |
| • Before employment | 58 | 19.2 |
| • After employment | 244 | 80.8 |
| **Types of the medical disease:** | | |
| • Hypertension | 85 | 28.1 |
| • Diabetes(Hypoglycemia) | 85 | 28.1 |
| • Renal failure | 50 | 16.5 |
| • Heart diseases | 12 | 3.9 |
| • Respiratory diseases | 34 | 11.2 |
| • Parasitic diseases | 8 | 2.6 |
| • Muscuskeletal diseases | 25 | 8.2 |
| • *others | 3 | 0.9 |
| **Pre-employment:(N=58)** | | |
| • Hypertension | 35 | 60.3 |
| • Diabetes | 10 | 17.2 |
| • Renal failure | 13 | 22.4 |
| **After the employment:((N=244)** | | |
| • Muscuskeletal diseases: | 25 | 10.2 |
| • Hypertension | 50 | 20.49 |
| • Diabetes | 75 | 34.7 |
| • Renal failure | 37 | 15.1 |
| • Heart diseases | 12 | 4.9 |
| • Respiratory diseases | 34 | 13.9 |
| • Parasitic diseases | 8 | 3.27 |
| • *Others | 3 | 1.22 |
| **The duration of the disease exposure :(N=250)** | | |
| • 1<5years | 119 | 47.6 |
| • 5<10years | 80 | 32 |
| • More than 10years | 51 | 20.4 |
| **Are you regularly taking medication for specific disease?** | | |
| • Yes | 205 | 81.0 |
| • No | 48 | 19.0 |

*****Others (as dermatitis)

***Figure (1): Total practices and preventive measure of work environment of the studied workers (n=500):***

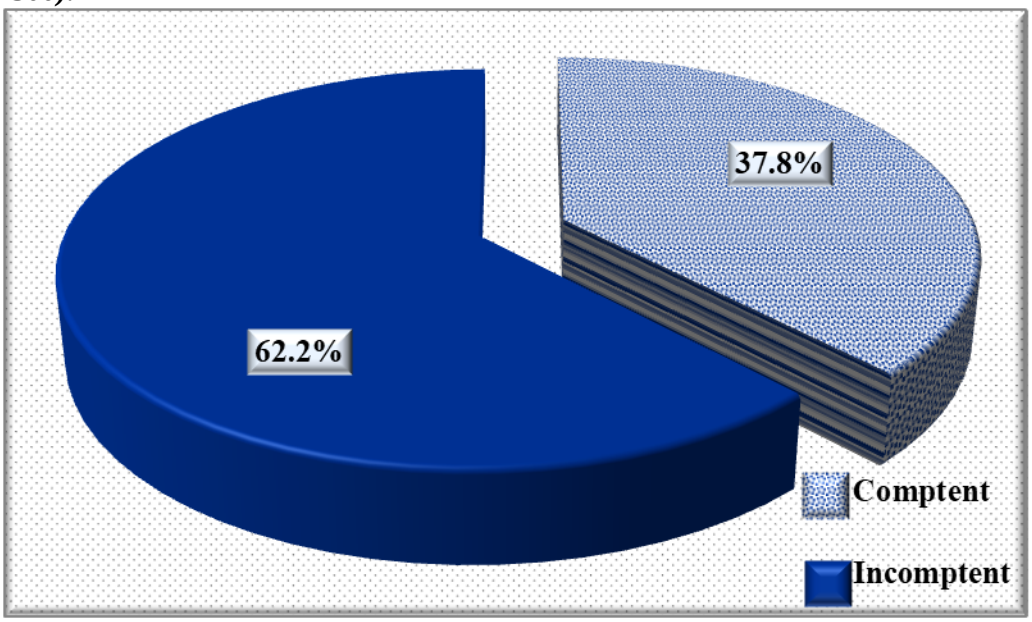


**Figure (2): Total score level of environmental safety of the studied workers**

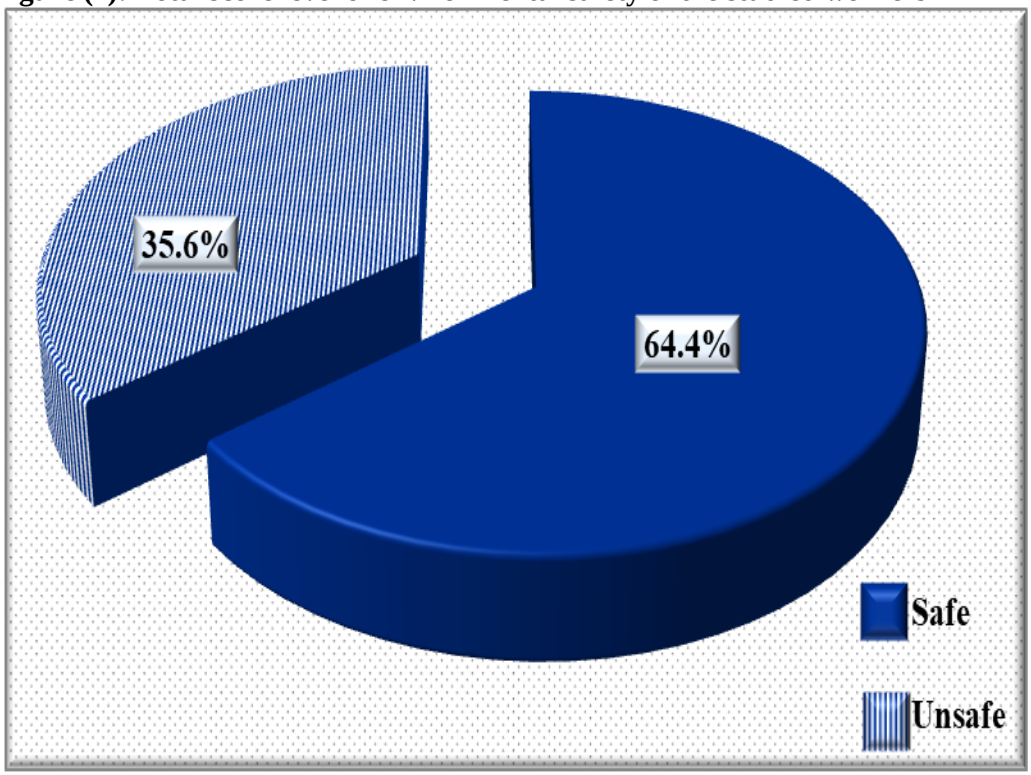

***Table (3): Relationship between the personal data of the studied workers and the total practices regarding occupational hazards (n=500):***

| Personal characteristics | Total practices regarding occupational hazards | | | | $X^2$ | P-value |
|---|---|---|---|---|---|---|
| | Competent (189) | | Incompetent (311) | | | |
| | N | % | N | % | | |
| **Age in years** | | | | | | |
| • 20-<30 | 4 | 2.1 | 11 | 3.5 | | |
| • 30-<40 | 24 | 12.7 | 97 | 31.2 | **25.165** | **0.001**$^{**}$ |
| • 40-<50 | 125 | 66.1 | 147 | 47.3 | | |
| • 50-60 | 36 | 19.0 | 56 | 18.0 | | |
| **Level of education:** | | | | | | |
| • Read and write | 19 | 10.1 | 20 | 6.4 | | |
| • Basic education | 59 | 31.1 | 113 | 36.4 | **3.372** | **0.338** |
| • Secondary school | 68 | 36.0 | 116 | 37.3 | | |
| • University education | 43 | 22.8 | 62 | 19.9 | | |
| **Marital status:** | | | | | | |
| • Single | 2 | 1.1 | 29 | 9.3 | | |
| • Married | 145 | 76.7 | 250 | 80.4 | **32.076** | **0.001**$^{**}$ |
| • Widower | 39 | 20.6 | 22 | 7.1 | | |
| • Separated | 3 | 1.6 | 10 | 3.2 | | |
| **Years of experiences:** | | | | | | |
| • < 5 years | 1 | 0.5 | 6 | 1.9 | | |
| • 5-<10 years | 29 | 15.3 | 63 | 20.3 | | **0.001**$^{**}$ |
| • 10-<15 years | 41 | 21.7 | 99 | 31.8 | **22.957** | |
| • 15-<20 years | 64 | 33.9 | 103 | 33.1 | | |
| • 20 or more | 54 | 28.6 | 40 | 12.9 | | |
| **Receive a training course related to work?** | | | | | | |
| • Yes | 139 | 73.5 | 273 | 87.8 | **16.429** | **0.001**$^{**}$ |
| • No | 50 | 26.5 | 38 | 12.2 | | |

Chi-square test ($^{**}$) highly statistical significant difference ($^{*}$) statistical significant difference

## Discussion

The gas industry is one of the most dangerous industries for workers because they are exposed to a wide range of occupational hazards, including chemical and biological agents, as well as agronomical and psychological risks. As a result, 2.9 billion workers worldwide are exposed to potential workplace risks, and workplace hazards remain a major source of concern for workers in this industry. Furthermore, two million deaths and 4% of GDP are attributed to occupational diseases and injuries each year. **Benson et al., (2021).**

The current study aimed to assess knowledge and safety practice of workers about occupational health hazards in butane gas tubes packing plant factory in Akhmim city at Sohag governorate.

Although this is a worldwide problem, the researcher could not access any study about knowledge and safety practice in butane gas packing plant factory in Egypt, So this topic is necessary done to assess workers' knowledge and safety practice.

**Regarding Personal data of the studied workers:** it was observed that more than half of the workers were between the ages of 41 and 50, with a mean ± SD of 34.2 ± 6.45. This might be because the butane gas tube packing plant factory had no appointments for a long period, so the workers were between the ages of 41 and 50. this study agreed with **Adedayo., et al (2023)** study who showed that the age of workers ranged between (29-55) years old. also, agreed with **Nyabuto et al (2021)** study who reported that, less than half of studied subject in the age group from 31<40 years old. On the other hand disagree with **Okafoagu et al.,(2017)** study who revealed that more than half of the studied sample were in the age group between 20-29 years old.

**According to level of education of the studied workers,** this study founded that about one-third of the workers in this study had only a basic school

certificate, and less than one-quarter had a university degree. The researchers believe this is because the Sohag people have a low socioeconomic status and the majority of them reside in rural areas. this finding disagreed with **Nyabuto et al (2021)** study and **Goda, et al .,(2023)** study who founded that nearly half of them had a secondary education. While, agreed with **Abd El Aziz & Abd- El Aal (2012**) study who revealed that more than half of the studies sample had a basic level of education. **According to area of residence,** this study demonstrated that more than three quarters of the studied workers are living in a rural area. On the investigator opinion, this result may be as the result of nature of sohag governorate as most of it's area is rural.

**Concerning to their marital status**, the current study revealed that more than half of workers were married, on the investigator point of view, this result may be due majority of the studied sample were more than marriage age between(41-50) years old. this finding came in agreement with **Elsayed et al.,( 2018)** study who founded that more than half of the workers were married .on the other hand, disagreed with **Johnson & Umoren.,(2018)** study who showed that most of the studied sample were single.

**According to the medical history of the studied workers,** the current study clarified that more than half of the subject had a medical history, most of them had a disease after the employment such as musculoskeletal disease as a result of heavy weight of the cylinder, and about half of them had the disease for 1-5 years. this result is consistence with **Sah, J. P et al.,(2015)** study that verified that 31% workers had been suffering from medical diseases and most of them had the disease after the employment such as musculoskeletal disease as a result of heavy weight of the cylinder .also, supported by **Okafoagu et al.,(2017)** study who showed that nearly half of workers suffered from respiratory disease and about three quarters had a rhinitis disease, some workers had a musculoskeletal diseases after the employment, this result may be as a result the heavy weight of the cylinders that lead to musculoskeletal diseases

**Concerning the total practices and preventive measure of work environment of the studied workers**, the current study illustrated that more than half of the workers were incompetent to practices and preventive measure of work environment, this result may be due to poor knowledge of the workers about the preventive measures and negligence of workers in how to perform the preventive measure due to financial reason and not availability of the facilities in the factory, this finding contradicted with **Mukhtar et al., (2020)** study who showed that half of respondents had a satisfactory practices of the safety measures. While, agreed with **OE and QM, (2018)** who carried a study in Uyo Nigeria about "assessment of occupational hazards, health problems and safety practices of petrol station attendants in Uyo Nigeria" which reported that only 7% of studies sample used the personal protective equipment and the safety measures.

**According to the total score level of environmental safety of the studied workers**, the current study reveals that more than half of the workers had a safe environmental workplace. On the investigator point of view this finding due to the state's interest in the petroleum sector, as it is one of the most dangerous sectors in the work environment, this finding in the line with **Abd El Aziz & Abd- El Aal (2012**) study that verified that the most of gas stations had an average cleanliness, while two fifths had good fire prevention measures, like the presence of fire extinguishers. Also, all the gas station had no posters for prevention of hazards. However disagreed **Elsayed et al., (2018)** study which showed that more than two fifths of the gas stations were unsafe working environment.

**Relationship between the personal data of the studied workers and the total practices regarding occupational hazards:** the current study demonstrated that there were a highly statistical significant difference between total practices and age , marital status, year of experience, receive a training course related to work regarding occupational hazards. On the investigator point of view, this finding due to presence of health clinic in the factory that providing a health education courses regarding the occupational hazards and safety measures which lead to increase knowledge leading to improve the safety practices. Additionally, there were no statistical significant different between level of education and total practices regarding occupational hazards this result in the line with **Quaigrain et al (2022)** study who reported that the year of experience of the workers promotes their safety practice. In addition, this finding was in agreement with **Goda, et al.,(2023)** study who founded that there were no statistical significant different between level of education and total practices regarding occupational hazards. however, disagreed with **Nkrumah et al.,(2020)** study who stated that workers level of education affects their health and safety practice.Also, disagreed with **Goda et al.,(2023)** study who stated that there were no statistical significant different between age, year of experiences and total practices regarding occupational hazards.

## Conclusion

The worker had unsatisfactory report about safety practice and preventive measures. So, most of the studied worker were exposed to the occupational health hazards**.**

## Recommendations

**In the light of the study's finding, the investigator is recommended that:**

1. Training and educational program regarding safety procedures and preventive measures in the butane gas packing plant.
2. Additional research to assess and improve the health of workers at factories that pack butane gas tubes in order to reduce dangers associated with their jobs
3. Books about safety precautions, including how to handle gas cylinders, how to handle emergencies in the case of an accident or fire, and how manufacturing workers should wear personal protective equipment.

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