

Performance of Laboratory Workers Regarding Occupational Health Hazards and Safety Measures at Hospitals in Ismailia City

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Abstract

Background: Laboratory workers are constantly subjected to health risks occasioned by their exposure to a wide range of biological, chemical, and physical occupational hazards. These exposures to occupational hazards arise in the manner the laboratory workers handle and use substances during their routine work. **Aim :** This study aimed to examine the performance of laboratory workers regarding occupational health hazards and safety measures at hospitals in Ismailia city. **A descriptive cross-sectional** design was utilized. **Sample :** convenience sample of 151 laboratory workers who were selected at hospitals in Ismailia city. **Tools :** two tools used in current study tool I-self-administer questionnaire included three parts. a-socio demographic data , b-knowledge of laboratory workers about occupational hazards, c- Attitude scale of laboratory workers about occupational hazards in the laboratory. Tool II observational checklist for general laboratory environment and reported practice among laboratory workers. **Results:** revealed that the knowledge level of the laboratory workers regarding occupational health hazard and safety measures, it was clarified that 55.6% of them had a good level of knowledge, 64.9% of laboratory workers had a positive attitude toward occupational hazards. There was statistical significance between demographic characteristics and practice among laboratory workers, ($P < 0.05$). **Conclusion:** more than half of the laboratory workers had a good level of knowledge regarding occupational health hazards and safety measures, two-thirds of them had a positive attitude toward occupational hazards in the laboratory and almost half of them had a fair level of practice. Additionally, nearly three-quarters of the selected settings had good levels of occupational safety measures. **Recommendation:** conduct development program for the laboratory workers to assessment, identification, evaluation activities and the risks from health hazards .

Keywords: Laboratory Workers, Occupational Health Hazard and Safety Measures.

1. Introduction

Occupational Safety and Health (OSH) focuses on safeguarding the well-being, health, and safety of employees in the workplace. It encompasses a wide range of practices, regulations, and programs aimed at preventing accidents, injuries, and illnesses related to work environments. OSH is a critical aspect of both labor laws and public health policies, and it covers various elements such as hazard identification, risk assessment, safety training, and the development of safety management systems (**Khaleghi et al., 2021**).

Occupational exposure is defined as any situation in which a worker is at work. By a wide margin, hepatitis B is the most common infectious disease that may be linked to a person's place of employment. Puncture wounds are the most common type of injury that can be sustained while working in the healthcare setting. Needles are responsible for causing these wounds. According to experts working in the medical area, one of the sorts of injuries that can arise as a direct result of clinical practice is the accidental sticking of a

patient with a needle (**Tan et al., 2021**).

Laboratory workers are constantly subjected to health risks occasioned by their exposure to a wide range of biological, chemical, and physical occupational hazards. These exposures to occupational hazards arise in the manner the laboratory workers handle and use substances during their routine work (**Almutairi et al., 2020**).

Laboratory biosafety describes the containment, principles, technologies, and practices that are implemented to prevent unintentional exposure to pathogens and toxins, or their accidental release. It is described as a safe method for managing infectious agents in a laboratory environment where they are handled and maintained. Implementation of biosafety precautions decreases the exposure to risk factors inside the laboratory. Standard precautions such as gloves wearing, hand washing, safety glasses, and face shields are highly recommended in diagnostic laboratories (**Islam et al., 2020**).

knowledge of secure laboratory working practices remains indefinable, so there is an imperative necessity for both globally recognized agreed codes of

standard precautions, as well as the innovation of regulations for the medical surveillance of laboratory workers, it is critical to use attitude measures to see and understand events based on specific tendencies to establish a unified construction. The practice of safety measures is characterized as the request for guidelines and knowledge that ultimately resulted in action. A great practice is a creative process that is concerned with the advancement of resources and information and is carried out properly (Thirunavukkarasu et al., 2021)

A laboratory is a controlled environment where scientific research, experiments, and measurements are conducted. Laboratories are essential for various fields, including chemistry, biology, physics, and medicine, as they provide the necessary equipment and conditions for precise and accurate work. They can range from small, simple setups to large, complex facilities with specialized instruments (Greaves et al., 2023).

Significance of the study:

Working in a medical laboratory presents several potential risks such as acupuncture, fire, and hazards associated

with constant movement during routine laboratory procedures. It has been established that workers in medical laboratories are subjected to significant occupational exposures, which places them at risk for a wide variety of potentially detrimental effects on their health (CheHuei et al., 2020).

In Egypt, the calculated weighted mean prevalence for HBV and HCV among the general populations including health team was 6.7% and 13.9% respectively assessment of lab safety is not a regular activity in most organizations, whereas it could be occurred in limited levels In the laboratories (Mahmoud and Sabry, 2019). Sharps injuries contribute to over 30% of new Hepatitis B cases and 2.5 percent annual HIV infections among health workers in the Sub-Saharan States in Africa (Tait, 2019).

Healthcare workers, including those working in laboratories, all over the world are the source of 16,000 new cases of the Hepatitis C Virus (HCV), 66,000 new cases of the Hepatitis B Virus (HBV), and 1000 new cases of Human Immunodeficiency Virus (HIV), respectively (WHO, 2021).

In an estimate by International Labor Organization (ILO), 160 million workers from the work force suffer disease related to work like mental health issues and musculoskeletal problems, whereas 270 million work related accidents cause 350,000 casualties; occupational hazards can be attributed to the 3 over two million work related deaths(**International Labour Organization, 2016.**)

Aim of the study

This study aims to examine the performance of laboratory workers regarding occupational health hazards and safety measures at hospitals in Ismailia city.

1. Assess the knowledge, and attitude of laboratory workers regarding occupational health hazards and safety measures at Ismailia city hospitals.
2. Observe practice and safety measures among laboratory workers at Ismailia city hospitals.
3. Find out the relationship between knowledge of occupational health hazards, safety measures, and practices among laboratory workers at Ismailia city hospitals.

Research questions

- 1.What are the main types of occupational hazards that face the personnel working in medical laboratories?
- 2.Have laboratory workers sufficient knowledge about occupational health hazards?
- 3.What are safety measures that laboratory workers apply in their workplace to protect them from potential hazards?

2. Subjects and methods

Research Design:

A descriptive cross sectional design was conducted for this study.

Research Setting:

The present study was conducted at 7 hospitals in Ismailia city namely, Ismailia medical Complex, 30 th June International Center for Dialysis and Urology,Suez Canal University Hospital,Ismailia Fever Hospital, Ismailia Chest Hospital, Ismailia Oncology Hospital, and Suez Canal university Specialized Hospital.

Subjects:

Convenience samples of 151 from laboratory workers were selected from the

hospitals mentioned above.

Sampling Description:

All laboratory workers (72 Technicians, 19 doctors, 55 chemists, and 5 nurses were included in the study).

Inclusion Criteria:

All laboratory workers (Technicians, doctors, chemists, and nurses were included in the study if available).

Tools of data collection:

Data were collected using two tools namely:

Tool I: A self-administered questionnaire included three parts

Part (1) Socio-demographic data: it includes basic demographic information, such as sex, age, year of experience, education, marital status, and number of hours of working per day.

Part (2) knowledge of laboratory workers about occupational hazards:

This part is adopted by (**Alshalani and Salma, 2019**), and consists of 18 items to assess the knowledge of laboratory workers about occupational health hazards and safety measures in the laboratory work environment. It includes: Do you have prior information about occupational

health, You are aware of the occupational risks you are exposed to in the laboratory, and you know the preventive measures to be taken inside the laboratory, ,etc.....)

Scoring system: measuring the score of laboratory workers' knowledge for each question was given yes=1, no=0. The scores of items were summed up and the total was divided by the number of the items, these scores were converted into percent score. The total knowledge scores were considered good Knowledge if the score of the total knowledge $\geq 85\%$, considered average if it is equals 60- 84%, and considered poor if it is $< 59\%$ (**Paul et al., 2022**).

Part (3) Attitude Likert scale of laboratory workers about occupational hazards in the laboratory: This scale was adopted by **Leung, (2021)**, and consists of statements to measure the attitude of laboratory workers about occupational health hazards and safety measures in the laboratory work environment, it includes statements as: "I feel that the lab is a safe environment to work", " I feel that I can use personal protective correctly to work in the lab", etc.....)

Scoring system: measuring the score of

laboratory workers' attitude as the following if the answer is "always" = (2), sometimes = (1), and rarely = (0). The total attitude scores were considered positive if the score of the total attitude was > 70 % - 100% and considered negative if it was less than < 70 (Alquraini et al., 2022).

Tool II: Observational checklist for general laboratory environment and reported practice among laboratory workers.

To assess occupational safety measures and reported practice regarding general practice and PPE inside lab adopted by (Alshalani and Salma, 2019) divided into two sections:

Section one consists of 51 items divided into 5 main points about occupational safety measures for the environment. The main five points are namely, the first point is general laboratory work environment (19 items) e.g. (lighting, warning signs); the second point is emergency planning (9 items). e.g. fire alarms, first aid kits, and emergency exits; the third point is electrical safety (6 items) e.g. cover plates; the fourth point is waste and hazardous waste management (9 items) e.g. waste

container and liquid chemical waste; the fifth point fume hood and chemical handling (8 items) e.g. chemical fumes, gas cylinder, and chemical storage cabinet.

Scoring system: Each item was assigned a score if Yes = (1), No = (0). Occupational safety measure is scored as good (score of 75-100%), fair (score 50-74%), and poor (score < 50%) (Mukhtar et al., 2020).

Section two the reported practices of laboratory workers: it includes questions about general practices and personal protective equipment. For examples; wash hands before leaving the lab, using the phone inside the lab, wearing overhead, and wearing gloves.

Scoring system: reported practices score for each answer was given as follows always done = (2), sometimes done = (1), rarely done = (0), reported practice will be scored as good practices (score of 75-100%), fair practices (score 50-74%), and poor practices (score < 50%) (Al-Abhar et al., 2017).

Fieldwork:

Initial assessment of each study participant in the previously mentioned settings using the study tool was carried out by the researchers. Data collection for this study

was carried out for 6 months from December 2022 until the end of May 2023, the morning shift is evaluated on Saturdays, and Sundays from 9.30 am to 11.30, evening shift is evaluated on Mondays and Tuesdays from 5 pm to 7 pm. Evaluate night shift Wednesdays and Thursdays of every week until data collection completed

Before collecting data, a standard verbal introductory message was introduced which the study focused on: clarifying the aim of the study to the laboratory workers, assuring privacy and the confidentiality of their answers. The data was collected by using structured interviews with hospitals laboratory workers. Participants were informed about their rights, including the possibility to withdraw at any time, and were debriefed about the purposes of the study and the use of their data.

The researchers introduced themselves to each laboratory worker to give his trust, and then all laboratory workers were selected conveniently and gave oral consent to participate were recruited into the study an explanation of the study objectives was provided, tell the laboratory workers that this data used only in the

scientific research and it is secret, using a self-administered questionnaire about history such as; information about demographic characteristics, knowledge, and attitude of laboratory workers, observational checklist for the general environment and reported practice about general practice and personal protective equipment the interview was last 30 minutes, after that assessment was done, it lasts about 30 minutes.

Pilot Study:

A pilot study was carried out after the development of the study tool before starting the data collection, including (10%) 15 of the total sample 150 laboratory workers. Data collection for was carried out for 1month from September 2022 until the end of October 2022, the morning shift is evaluated on Saturdays, and Sundays from 9.30 am to 11.30, evening shift is evaluated on Mondays and Tuesdays from 5 pm to 7 pm. Evaluate night shift Wednesdays and Thursdays of every week until data collection Completed to check the validity clarity, and applicability of the study tool. Based on the results of the pilot study, the necessary modification was made, and the final form

of tool was developed as well as those laboratory workers were not included in the main study sample.

Ethical Considerations

The Research Ethics Committee (REC) in the Faculty of Nursing, Suez Canal University reviewed the study with approved code (155/6-2022). Personal communication was done with workers to explain the purpose of the study, ensure

Statistical Design:

Data collected through the questionnaire were coded, entered, and analyzed using Statistical Package for the Social Sciences (SPSS version 23). The chi-square test was used to test the relation between categorical variables and Monte Carlo correction was used for low cell values. Correlations were used to test relationships between different variables. The p-value was set at <0.05 for significant results.

4. Results

Table (1) shows that the mean age of laboratory workers was 38.29 ± 8.96 . Also, 75.5% of them were married. Regarding education level, 50.3% had a diploma.

their best possible cooperation, and ensure the confidentiality of the data. The researchers emphasized to workers that the study was voluntary and anonymous. Workers had the full right to refuse to participate in the study or to withdraw at any time without giving any reason. Approval was obtained from the research ethical committee affiliated with the Faculty of Nursing-Suez Canal University.

The following Statistical techniques were used: Percentage, Mean score degree, Standard deviation (SD), Pearson correlation (r test), Chi-square test, and Fisher exact test for 2*2 table, Monte Carlo correction for Chi-square test, Proportion probability of error (P- value) and confidence interval. Significance of results: When $P < 0.05$, there is a statistically significant difference., When $P < 0.01$, there is a highly statistically significant. .

Table (2) reveals that 97.4% of laboratory workers spent more than 8 hours of work and 87.4% of them had more than five years of experience. Also, 51% of them are exposed to hazards, and according to the

type of hazards, 59.7% are exposed to biological hazards

Figure (1) shows that 55.7 % of laboratory workers had a good level of knowledge regarding occupational health hazards and safety measures.

Figure (2) shows that 64.9% of laboratory workers had a positive attitude toward occupational hazards in the laboratory

Figure (3) show that 73% of selected setting had good level of occupation safety measure .

5.Discussion

The clinical laboratory is a workplace where many occupational hazards such as chemicals, complex instrumentation, and potential pathogens are encountered daily. However: the laboratory can be a safe place to work and learn if possible, hazards are identified; safety and infection control protocols are followed. Education of healthcare professionals about the general

laboratory had fair reported practice

Table (3) shows that there was a positive correlation between total knowledge and total practice score with $r.178$, and P value 0.029 . Also, there was a positive correlation between total knowledge and total attitude score with $r.199$, and P value >0.14

prevalence, risk of transmission, and availability of prophylaxis and treatment is imperative. Knowledge related to the importance of taking basic precautions through the use of gloves, gowns, and masks has been proven to decrease exposure incidents (Tahira et al., 2020).Therefore, this study aimed to examine the performance of laboratory workers regarding occupational health hazards and safety measures at hospitals in Ismailia city.

Regarding demographic characteristics of laboratory workers, the current study revealed that the mean age of laboratory workers was 38.29 ± 8.96 years. This result was in accordance with **(Ekwempu et al., 2018)** who conducted a study about "Occupational Hazards: Knowledge, Attitude, and Perception of Medical Laboratory Scientists in Nigeria", and found that the mean age of the laboratory workers was 37.4 ± 7.8 years.

While the study carried out by **(Tait et al., 2019)** entitled "Occupational Safety and health status of medical laboratories in Kajiado County, Kenya", reported that the mean age of participants was 30.1 years \pm 7.1 SD. From the research point of view, this could be because this age range lies within the productive age in the workforce in the hospital.

In addition, the current study represented that about three-quarters

of the laboratory workers were married result was in accordance with **(Thirunavukkarasu et al., 2021)** who conducted a study about "Prevalence and Risk Factors of Occupational Health Hazards among Health Care Workers of Northern Saudi Arabia" and found that the majority of the laboratory workers was married.

Also, a study carried out by **(Alam et al., 2022)** who conducted a study entitled "Assessment of Biosafety Practices in Clinical Laboratories in Khartoum State, Sudan" and found that most of the laboratory workers were married. From the research point of view, this might be due to more than half of the studied laboratory workers aged from 32 to less than 42 years old.

Also, the current study reflected that about half of the laboratory workers had diplomas. This result was similar to **(Mahmoud & Sabry 2019)**, who studied "Safety training program for clinical

laboratory workers regarding prevention of occupational hazards" This study was carried out in Benha City, Egypt and they reported that the highest percentage of the laboratory workers had secondary education.

In contrast, a study done by **(Khabour et al., 2018)**, entitled "Assessment of biosafety measures in clinical laboratories of Al-Madinah City, Saudi Arabia" stated that the largest proportion of the studied subjects were bachelor's degree holders. From the research point of view, this might be due to secondary education being the main previous education for laboratory technicians. This discrepancy may be attributed to different sample characteristics and different settings.

Concerning work-related data of laboratory workers, the current study showed that most laboratory workers spent more than 8 hours of work. This result was compatible with a study carried out

by **(Sheshi & Agbana, 2019)** who studied "Prevalence of Occupational Diseases and Practice of Safety Control Measures among Health Workers of General Hospital Minna" and found that the highest percentage of the studied sample worked for more than 8 hours.

In the opposite line, **(El Metwaly et al., 2023)** who conducted a study about "Preventive Measures among Hospital Laboratory Employees regarding Occupational Health Hazards", this study carried out in four governmental hospitals in Benha City, Egypt found that more than two-thirds of them worked for 6 hours\ day. From the research point of view, This might be due to the policy of the department.

Additionally, the current study revealed the majority of the laboratory workers had more than five years of experience. Likewise, a study carried out by **(Boyacı et al., 2021)** entitled "Laboratory employees' perception of

occupational risk factors" this study carried out in Istanbul, Turkey reported that the highest percentage of the studied respondents had more than five years of experience. On the contrary, a study conducted by **(Ahmed et al., 2022)** about "Appraisal of Biosafety Measures in Governmental Medical Laboratory Personnel" this study carried out in Sudan and reported that half of the subjects had work experience ranging from 1 to 5 years.

Besides, the present study indicated that more than half of the laboratory workers were exposed to hazards, and more than half of them were exposed to biological hazards. Similarly, a study carried out by **(Tahira et al., 2020)**, entitled "Occupational Health Hazards and Needle Stick Injuries among Medical Laboratory Workers" this study carried out in Lahore, Pakistan found that more than half of the respondents experienced occupational hazards.

Regarding laboratory workers' total knowledge regarding occupational health hazards and safety measures, the present study displayed that the total mean score of their knowledge was 14.89 ± 2.46 , and more than half of them had satisfactory levels of knowledge regarding occupational health hazards and safety measures. From the research point of view, this may relate to the laboratory workers' years of experience and training courses about occupational health hazards and safety measures.

Along the same line, a study conducted by **(Zakaria et al., 2020)** entitled "Assessment of Knowledge, attitude, and Practices of Laboratory Workers Towards Chemical Safety in University Teknologi Mara Campuses, Malaysia" reported that most of the respondents' knowledge about chemical safety was high, in the contrast the study by **(Almutairi et al., 2020)** declared that most laboratory workers had poor

knowledge, Also, the study by (Islam et al., 2021) who studied "Knowledge of biosafety measures among laboratory personnel at tertiary level public hospitals in Dhaka city" and reported that most of the respondents had inadequate knowledge about biosafety measures.

Concerning the percentage distribution of the laboratory workers' attitudes toward occupational hazards in the laboratory. The present study findings revealed that less than two-thirds of them take care of the lab and keep it clean and tidy. From researcher point of view, they realize that if they don't care about the cleanliness and arrangement of the laboratory, it will lead to serious problems.

This study finding was consistent with a study conducted in Africa by (Lopata et al., 2020) who studied "Occupational allergy in laboratory workers caused by the African migratory grasshopper *Locusta migratoria*", revealed that the

most of studied sample take care of the lab.

According to the laboratory workers' reported practice, the current study demonstrates less than three-quarters of the laboratory workers always wash their hands before putting on gloves also more than half of them always wash their hands before leaving the laboratory, while (Akkajit et al., 2020) who studied "Assessment of knowledge, attitude, and practice in respect of medical waste management among healthcare workers in clinics" conducted in Phuket, Thailand and reported that the majority of their sample wash hands before and after any work in lab. From the researcher point of view, these results might be because of the laboratory workers viewed their jobs as high risk and used personal protective equipment (PPE) to reduce occupational hazards.

Regarding the correlation between laboratory workers' total

knowledge, attitude, and practice, the present study portrayed that there were positive correlations between total knowledge, practice, and attitude scores. This can be interpreted as the level of knowledge directly reflected in the level of attitude and practices among laboratory employees. Also, the attitude had the greatest influence on occupational health practices.

This result agreed with (Mahmoud & Sabry, 2019), who reported that there was a positive correlation between the total knowledge scores of the studied laboratory workers and their total practice scores. These findings were in harmony with a study done by (Zakaria et al., 2022) reported that there were weak positive correlations between attitudes and the level of knowledge and practices.

6. Conclusion

In light of the present study findings, it can be concluded that more than half of the studied laboratory

workers had a satisfactory level of knowledge regarding occupational health hazards and safety measures, and nearly two-thirds of laboratory workers had a positive attitude toward occupational hazards in the laboratory and almost half of them had a fair level of reported practices. Additionally, nearly three-quarters of the selected settings had good levels of occupational safety measures. According to the relation between demographic characteristics and practice among laboratory workers, it was reported that there was a statistically significant difference between years of experience and level of reported practice.

7. Recommendations

In light of the findings of the current study the following recommendations are suggested:

1. Development program for the laboratory workers about:
 - Assessment, identification, Evaluation activities, and the risks from health

hazards.

- Refreshment knowledge of laboratory workers and encouraging good practice to prevent occupational health hazards.

For Conduct Future Research as

Recommended as:

- Further investigations are needed to compare the results with different settings.

Table (1): Percentage distribution of the laboratory worker according to their demographic characteristics (N=151).

| Items | N. | % |
|-----------------------|-------------------|-------------|
| Age (Years) | | |
| 22<32 years | 36 | 23.8 |
| 32<42 years | 59 | 39.1 |
| 42<52 years | 38 | 25.2 |
| 52 <62 years | 18 | 11.9 |
| Mean ±SD | 38.29±8.96 | |
| Min-Max | 23-58 | |
| Gender | | |
| Male | 74 | 49.0 |
| Female | 77 | 51.0 |
| Marital status | | |
| Single | 35 | 23.2 |
| Married | 114 | 75.5 |
| Divorced/Widowed | 2 | 1.3 |
| Education | | |
| Diploma | 76 | 50.3 |
| Bachelor | 55 | 36.4 |
| Master | 16 | 10.7 |
| Doctorate | 4 | 2.6 |
| Job inside lab | | |
| Physician | 19 | 12.6 |
| Nurse | 5 | 3.3 |
| Technician | 72 | 47.7 |
| Chemist | 55 | 36.4 |

Table (2): Percentage distribution of the laboratory workers regarding their work characteristics (N=151)

| Items | N. | % |
|--------------------------------------|-----|-------------|
| Hours of work | | |
| <8 h | 4 | 2.6 |
| ≥8h | 147 | 97.4 |
| Experience (years) | | |
| <5 | 19 | 12.6 |
| ≥5 | 132 | 87.4 |
| Expose to Hazards | | |
| Yes | 77 | 51.0 |
| No | 74 | 49.0 |
| If yes Type of hazards (n=77) | | |
| Chemical | 26 | 33.8 |
| Biological | 46 | 59.7 |
| Physical | 5 | 6.5 |

Figure (1): knowledge levels of the laboratory workers regarding occupational health hazards and safety measures (N=151).

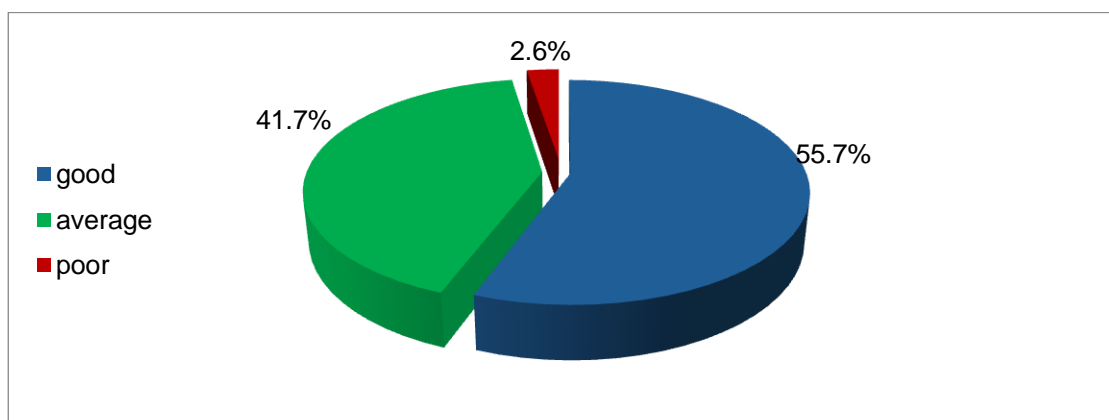


Figure (2): level of laboratory workers attitude toward occupational hazards in laboratory (N=151).

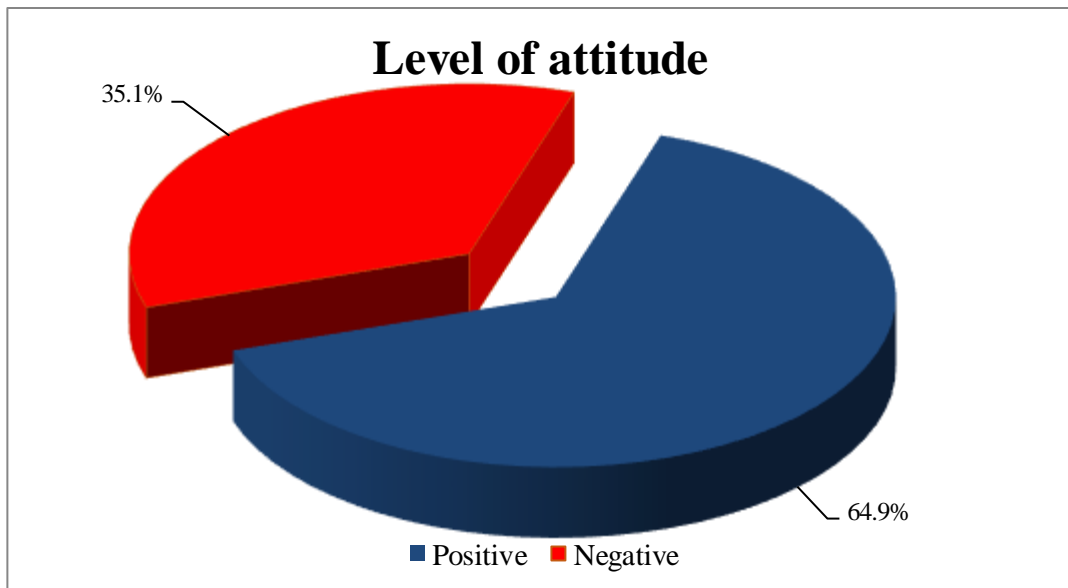


Figure (3): level of occupational safety measure among laboratory workers (n=7).

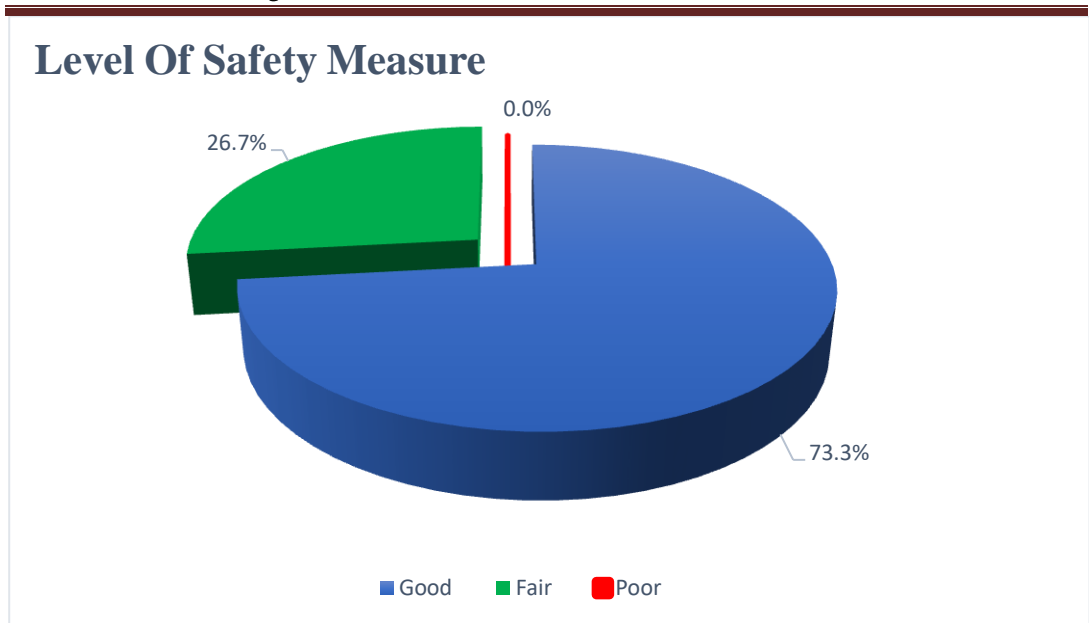


Figure (4): Level of reported practice of laboratory workers (N=151)

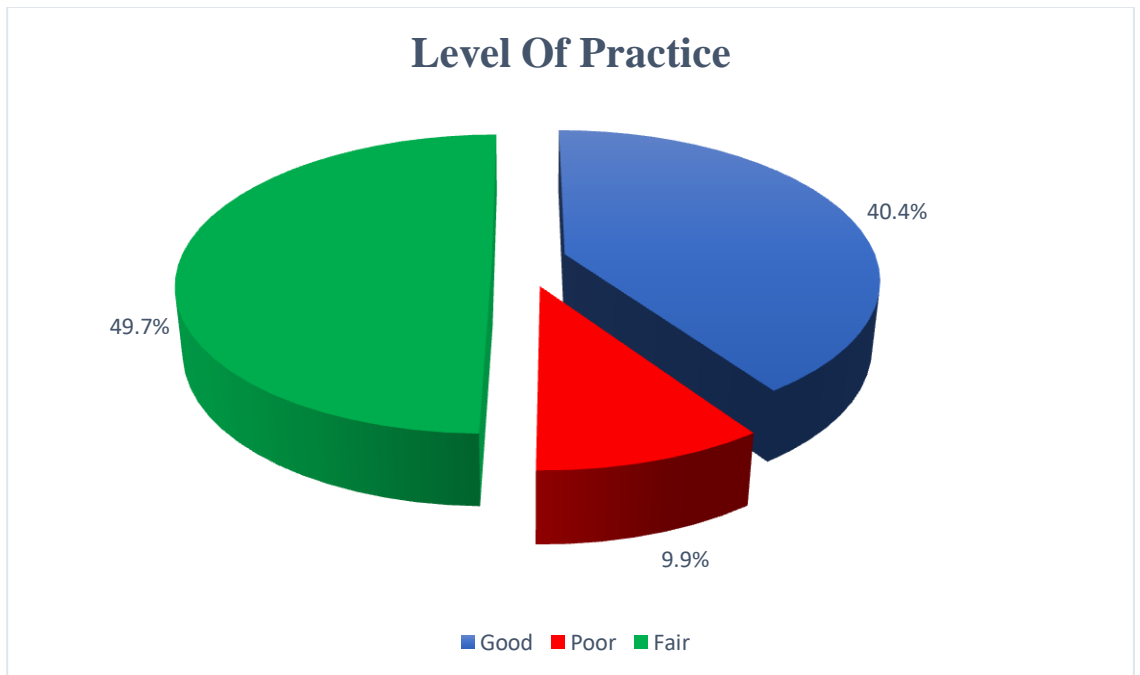


Table (3) Correlation between the laboratory worker knowledge attitude scores, total practice, and total scores (n=151).

| Items | Knowledge | Attitude | Practice |
|------------------------------|--------------|-------------|----------|
| Total Knowledge Score | — | | |
| Total Practice Score | .178 (√.029) | — | |
| Total Attitude Score | .199 (√.014) | .118 (.151) | — |

The test used was the Pearson correlation test, P value is significant <.05

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