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Workers Health Risk Exposure and Type in Medical Laboratory at Imam Al-Mahdi University-White Nile State, October 2022 to March 2023

[1]**Mariam Saeed Ibrahim Essa , [2]Dafallah Abdelgadir Mokhtar Esmail, [3] Nada Ali Abozaid , [4]Anas Ali Alhur, [5] Mohammed Ali M Alshammari , [6]FATEN INAD SALEM ALSHAMMARY, [7]Fatimah Fareeh Batah Al-Shammary , [8] Alanood Hmood Nazil Alshammary, [9] Shwagaha Hmood Nazil Alshammary , [10] Sarah masoud saad alshammary , [11] Hamidah Dhahy Hzab Alshammari**

[1]Assistant Prof. Faculty of Public Health and Informatics Hail University and Environmental Health, El Imam El Mahdi University

[2]Assistant Prof. Faculty of Public and Environmental Health, El Imam El Mahdi University

[3]Assistant Prof. Faculty of Public Health and Informatics Hail University and Environmental Health, El Imam El Mahdi University

[4]Hospital and Health Services Management Alshennan General Hospital

[5]Bachelor of Social Science Mawqaq General Hospital

Infection prevention and control diploma Alshennan general hospital 6

[7,8,9]BSc. Students, Faculty of Public and Environmental Health, El Imam El Mahdi University

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Abstract:

Background: The health of healthcare workers is critical to the effective operation of any medical organization. The well-being of laboratory staff is essential to the efficient functioning of healthcare organizations.

Objectives: The present study aimed to assess the workers' health risk exposure and type in medical laboratory at Imam Al-Mahdi University-White Nile State, October 2022 to March 2023.

Methods: This was a descriptive cross-sectional study. The study was conducted in Kosti City located in the central south of the White Nile State. All workers in the laboratories of Imam AL-Mahdi Medical University were recruited for the study. Data was analyzed using SPSS version 24.0. Data was collected using structured questionnaires. The results were presented in forms of tables and figures.

Results: The study revealed that the most worker's hazards exposed in medical laboratories were lighting (75.6%), Ergonomic (70.7%) and chemical hazards (68.3%). While the most common type of biological hazards were bacteria (41.5%), most common types of chemical hazards in medical laboratories were sulfuric acid (21.4%), types of physical hazards were electricity related hazards (70.7%), types of thermal were heat stress (50%). The most common type of noise hazard was intermittent noise (53.7%) while the most common of lighting hazards was eye strain (58.5%). Additionally, the most common types of radiation were ionizer (39%), the most common types of chemical hazards were sulfuric acid (21.4%). However, stairs were the most common types of mechanical hazards 41.5%. Moreover, in appropriate design of workplace (41.5%) were the most common types of ergonomic hazards, while personal factors (43.9%) were the most common types of psychological hazards. The study proved that there was positive correlation between different hazards exposure, types of hazards in medical laboratories in relation to workers age group and education level, $p<0.05$.

Conclusion: Raising awareness of safety procedures in medical laboratories and improving laboratory infrastructure and design can contribute significantly to preventing risks to which medical laboratory personnel are exposed.

Keywords: *health risk, affects, medical laboratories workers, El Imam El Mahdi University.*

المستخلص:

الخلفية: صحة العاملين في مجال الرعاية الصحية أمر بالغ الأهمية للتشغيل الفعال لأي منظمة طبية. كما أن سلامة موظفي المختبر ضرورية لضمان كفاءة عمل منظمات الرعاية الصحية.

الأهداف: هدفت هذه الدراسة إلى تقييم تعرض العاملين للمخاطر الصحية ونوعها في المختبر الطبي بجامعة الإمام المهدي – ولاية النيل الأبيض، خلال الفترة من أكتوبر 2022 إلى مارس 2023.

المنهجية: كانت هذه دراسة وصفية مقطعية. أجريت الدراسة في مدينة كوستي الواقعة في وسط جنوب ولاية النيل الأبيض. تم تجنيد جميع العاملين في مختبرات جامعة الإمام المهدي الطبية للدراسة. تم تحليل البيانات باستخدام برنامج SPSS الإصدار 24.0. تم جمع البيانات باستخدام استبيانات منظمة. تم عرض النتائج في شكل جداول وأشكال.

النتائج: كشفت الدراسة أن أكثر المخاطر التي يتعرض لها العاملون في المختبرات الطبية كانت الإضاءة (75.6%)، وبيئة العمل (70.7%)، والمخاطر الكيميائية (68.3%). في حين أن أكثر أنواع المخاطر البيولوجية شيوعًا كانت البكتيريا (41.5٪)، وكانت أكثر أنواع المخاطر الكيميائية شيوعًا في المختبرات الطبية حمض الكبريتيك (21.4٪)، وكانت أنواع المخاطر الفيزيائية مخاطر متعلقة بالكهرباء (70.7٪)، وكانت أنواع المخاطر الحرارية الإجهاد الحراري (50٪). وكان أكثر أنواع مخاطر الضوضاء شيوعًا هو الضوضاء المتقطعة (53.7٪)، بينما كان أكثر مخاطر الإضاءة شيوعًا هو إجهاد العين (58.5٪). بالإضافة إلى ذلك، كانت أكثر أنواع الإشعاع شيوعًا هي المؤين (39٪)، وكان أكثر أنواع المخاطر الكيميائية شيوعًا حمض الكبريتيك (21.4٪). ومع ذلك، كانت السلالم أكثر أنواع المخاطر الميكانيكية شيوعًا بنسبة 41.5٪. علاوة على ذلك، في التصميم المناسب لمكان العمل (41.5٪) كانت أكثر أنواع المخاطر المريحة شيوعًا، بينما كانت العوامل الشخصية (43.9٪) أكثر أنواع المخاطر النفسية شيوعًا. أثبتت الدراسة وجود علاقة إيجابية بين التعرض للمخاطر المختلفة، وأنواعها في المختبرات الطبية، تبعًا لمتغيرات عمر العاملين ومستوى تعليمهم، ($p<0.05$).

الخلاصة: إن رفع مستوى الوعي بإجراءات السلامة في المختبرات الطبية، وتحسين البنية التحتية للمختبرات وتصميمها، يُسهم بشكل كبير في الوقاية من المخاطر التي يتعرض لها العاملون في المختبرات الطبية.

الكلمات المفتاحية: المخاطر الصحية، التأثيرات، العاملون في المختبرات الطبية، جامعة الإمام المهدي.

Introduction:

The health of healthcare workers is critical to the effective operation of any healthcare organization. Laboratory staff play an important role in testing patients' body fluids for harmful microorganisms and abnormalities (Algarni, et al., 2023). However, these healthcare workers face a number of occupational hazards that can be hazardous to their health if appropriate precautions are not taken (Alshalani & Salama, 2019). These hazards can be defined as anything that can cause harm when laboratory staff are exposed. The health of laboratory staff is critical to the efficient functioning of a health care institution (Algarni, et al., 2023).

Biological hazards are organisms such as bacteria, viruses, fungi, and fragments that can enter the body and cause infection (World Health Organization. 2001). Medical laboratories pose a variety of risks to laboratory staff who handle a variety of biological agents, increasing the risk of infection. A cross-sectional study conducted in a Kenyan healthcare facility with a medical laboratory found that the biological risk of exposure to bacteria was 80%, exposure to parasites was 47%, exposure to viral vectors was 8%, and exposure to fungi was 17%, with an average of 65.5% of medical laboratory personnel exposed to one or more biological risk factors (Tait, 2019). Needles and sharp knives, such as scalpels and broken glass, are significant risks in the laboratory environment. These contaminated needles and sharps inject blood containing pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) into health care workers. All of these can pose a potentially fatal risk to the health of health care workers. A survey of health care workers in British Columbia found that laboratory assistants had the highest rates of exposure from infected needles and droplets (Akhter et al., 2011).

Chemical hazards can take the form of gases, solids, liquids, mists, fumes, dust clouds, and vapors, which can be toxic when inhaled, absorbed through the skin, or ingested (Alshalani & Salama, 2019). These hazardous substances pose a threat to the health and safety of laboratory staff (World Health Organization. 2001). Medical laboratories must be adequately equipped to handle hazardous chemicals. For example, medical laboratories should be equipped with chemical fume hoods for handling hazardous chemicals; furthermore, employees should be adequately trained and equipped with appropriate personal protective equipment (PPE) (Alqam, 2013).

Examples include formaldehyde, formalin, and xylene. These chemicals are carcinogens according to IARC (Suvarna et al., 2018). Medical laboratories must have appropriate equipment and precautions in place to handle hazardous chemicals. This includes the use of chemical fume hoods and the provision of personal protective equipment (PPE) for employees (Alqam, 2013).

Physical hazards include contact with mechanical or other objects that can cause health hazards (Alqam, 2013). These include extreme temperatures, ionizing and non-ionizing radiation, constant loud levels of noise, lighting, vibration, and electric shocks (World Health Organization. 2001). Musculoskeletal injuries, at 10.5%, are considered the most common type of physical injury among clinical laboratory technologists, with back pain being second, and the most affected organs of the body being the muscles of the lower back, legs, and hands, with improper lifting of instruments being the primary cause of these injuries (Chhabra, 2016). Repetitive movements performed by medical laboratory staff, such as dispensing, using microscopes, operating microtome equipment, and typing, can lead to long-term injuries due to repetitive stress on muscles, tendons, and joints. This type of injury is referred to as an ergonomic hazard (Alqam, 2013). Safety practices play an important role and are a major concern in clinical laboratories because of the handling of hazardous and infectious materials. Risks to which medical laboratory staff are exposed can be eliminated or reduced by educating, promoting, and disseminating good hygiene laboratory practices to employees and providing appropriate safety equipment. Good hand hygiene contributes to the prevention of hazards during work (Nasim et al., 2010). Laboratory technicians' safety behaviors and attitudes, educational programs, and laboratory safety are important for the control and prevention of hazards, but lack of knowledge or negligence can lead to laboratory accidents, exposing themselves and others to serious danger. Inadequate technique, carelessness or negligence in handling contaminated instruments and equipment, and exposure to aerosol infections and needle sticks are the leading causes of laboratory acquired occupational infections (Nasim et al., 2010). The rapid increase in

laboratory accidents is due to laboratory technicians' lack of knowledge of proper testing measures and techniques, negligence in applying and following safe testing procedures, and careless behavior of workers (Casanova et al., 2008).

The purpose of this study was to assess the health risk exposures and their types among workers in the medical laboratory of Imam Al Mahdi University (White Nile State) during the period from October 2022 to March 2023.

MATERIALS AND METHODS

Study Design:

Descriptive cross sectional study.

Study area:

Kosti city located in the central south of the White Nile state, between latitudes {13.40-13.12} and longitudes {41, 32-31, 39} East. The area is 878 Kilometers, The population is 41, 7204 the number of villages are 47 and the number of neighborhoods are 114 villages. The highest temperatures ranging between 42 degrees Celsius in April and 33 degrees Celsius in August and in the period and between October and May. The city is subject to relative humidity by alternation of seasons.

Study population:

All workers in the laboratories of Imam AL-Mahdi Medical University.

Sample size:

The sample size was including all the laboratory workers in Al Imam Al-Mahdi University.

Data collection methods:

Self-administered questionnaires were used to collect data from the workers and the laboratory environment to determine the health hazards. The questionnaire consists of two parts, the first part was personal information such as age, type of work, educational level), the second part includes general information about the laboratories, risk to which workers are exposed, action taken to prevent hazards and health services that must be available in the laboratories.

Data analysis:

Data was analyzed using SPSS version 24.0. The results were presented in forms of tables and figures.

Results:

Table 1 indicates the socio-demographic information of the participants. The majority of workers were male 70.7% while 29.3% were female. Most of workers 56.1% aged between 26-33 years. More than half of the workers 51.2% had college education.

In table 2, shows that 56.1% of workers exposed to physical hazards. Nearly two thirds 58.5% of the workers exposed to thermal hazards. A number of 23 workers which represent 56.1% were exposed to noise hazards. The majority of workers were exposed to lighting hazards in medical laboratory. In addition, 58.5% of workers exposed to radiation hazards while 68.3% of workers in medical laboratories exposed to chemical hazards. The biological hazards among workers in medical laboratories represent 41.5%. More than two thirds of workers 61% exposed to psychological hazards. The mechanical hazards in medical laboratories was found to be 43.9% while exposure to

Ergonomic hazards were occurred among the majority of workers 70.7%.

The most type of physical hazards was electricity related hazards 70.7%, figure 1. Heat stress was the most type of thermal hazards 50% followed by sun stroke 30% as shown in figure 2.

Figure 3 indicates that the most type of noise hazards among workers was intermittent noise 53.7%.

Eye strain 58.5% was the most type of lighting hazards occurred among medical laboratories workers, figure 4.

The type of radiation hazards reported among workers were ionizers 39%, non-ionizer 9.8% and other 51.2%, figure 5.

Figure 6 indicates that the most medical laboratory workers were exposed to sulfuric acid 21.4%, chloride acid 14.3%, organic soil 14.3% and mineral dust 10.7% while exposed to lead fumes 7.1%, carbon monoxide 7.1%, hydrogen sulfide 7.1%, potassium hydroxide 3.6%, sodium hydroxide 3.6%, mineral dust and chloride acid 3.6% and exposed to others type of chemical hazards was found to be 7.1%.

Figure 7 shows that, 41.5% of the workers reported exposure to bacteria, 2.4% reported exposure to parasites, 2.4% reported exposure to viruses, and 53.7% reported exposure to others biological hazards such as protozoa.

Stairs 41.5%, electricity 34.1%, tools 19.5% and machine and equipments were the most type of mechanical hazards in medical laboratories as shown in figure 8.

The most type of ergonomic hazards was resulted from in appropriate design of workplace 41.5%, poor work practice 14.6%, poor design of machine 14.6% and others type represent 31.7%, table 9.

The most type of psychological hazards was personal 43.9%, social 22% and others 34.1%.

Table 3 shows the person's correlation between workers' health risk exposure in medical laboratories and socio-demographic information. There was positive correlation between exposure to physical, thermal, noise, lighting, radiation, chemical, biological, psychological, mechanical and ergonomic hazard and age group and education level, p<001.

Regarding gender correlation, the only positive correlation was found between gender and exposure to biological hazards, (r^2=.324, p=.039).

Table 4 indicates the person's correlation between workers' health risk type in medical laboratories and socio-demographic information.

There was positive correlation between type of physical, thermal, noise, lighting, radiation, chemical, biological, psychological, mechanical and ergonomic hazards and age group and education level, p<001.

The type of thermal hazards (r2=.323, p=.039), noise (r^2=.321, p=.040) and lighting (r^2=.368, p=.018) were positively correlated with gender.

Table 1. Socio-demographic information of the participants

Response	**No.**	**%**
Gender		
Male	29	70.7
Female	12	29.3
Total	41	100.0
Age group		
18-25	4	9.8
26-33	23	56.1
34-40	1	2.4
> 40	13	31.7
Total	41	100.0
Education level		
Secondary	3	7.3
College	21	51.2
Other	17	41.5
Total	41	100.0

Table 2. Workers health risk exposure in medical laboratories

Response	No.	%
Physical hazards		
Yes	23	56.1
No	18	43.9
Total	41	100.0
Thermal hazards		
Yes	24	58.5
No	17	41.5
Total	41	100.0
Noise hazards		
Yes	23	56.1
No	18	43.9
Total	41	100.0
Lighting hazards		
Yes	31	75.6
No	10	24.4
Total	41	100.0
Radiation hazards		
Yes	24	58.5
No	15	36.6
Probable	2	4.9
Total	41	100.0
Chemical hazards		
Yes	28	68.3
No	13	31.7
Total	41	100.0
Biological hazards		
Yes	17	41.5
No	24	58.5
Total	41	100.0

Response	No.	%
Psychological hazards		
Yes	25	61.0
No	16	39.0
Total	41	100.0
Mechanical hazards		
Yes	18	43.9
No	23	56.1
Total	41	100.0
Ergonomic hazards		
Yes	29	70.7
No	12	29.3
Total	41	100.0

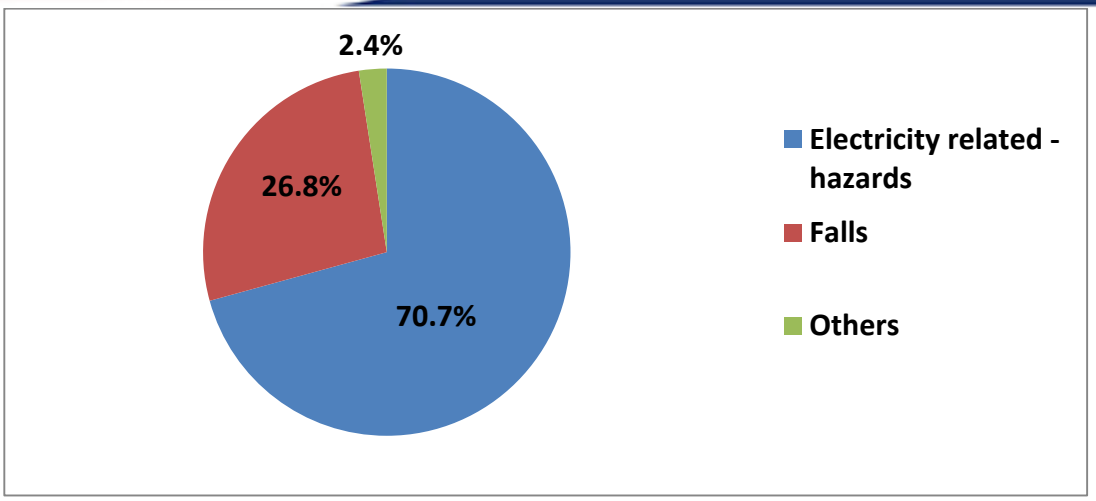

Fig.1. Distribution of type of physical hazards among participants (n=41)

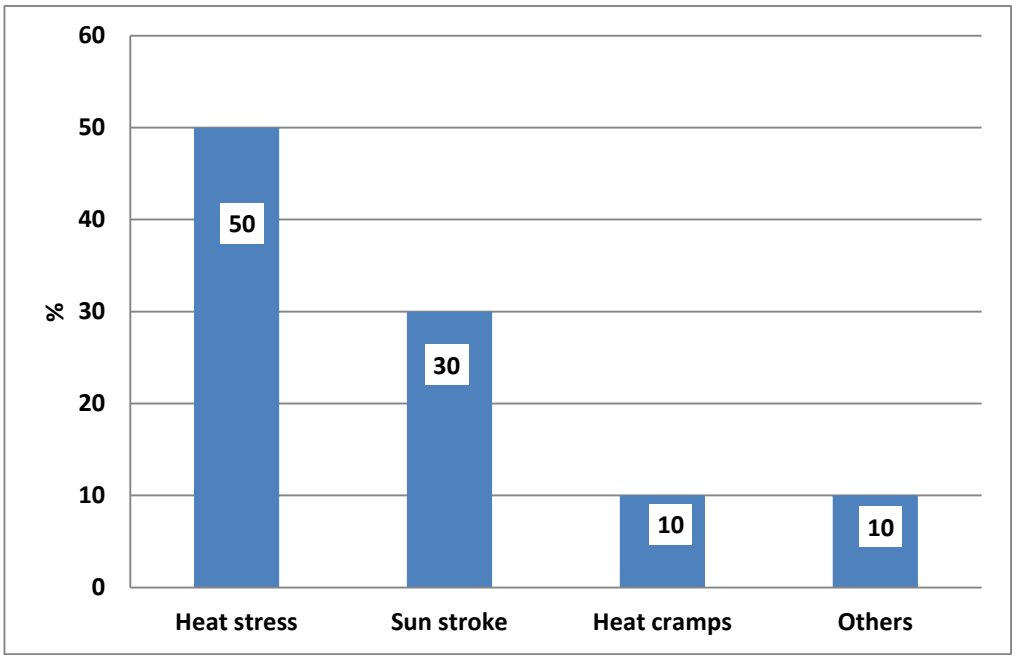

Fig.2. Distribution of type of thermal hazards among participants (n=30)

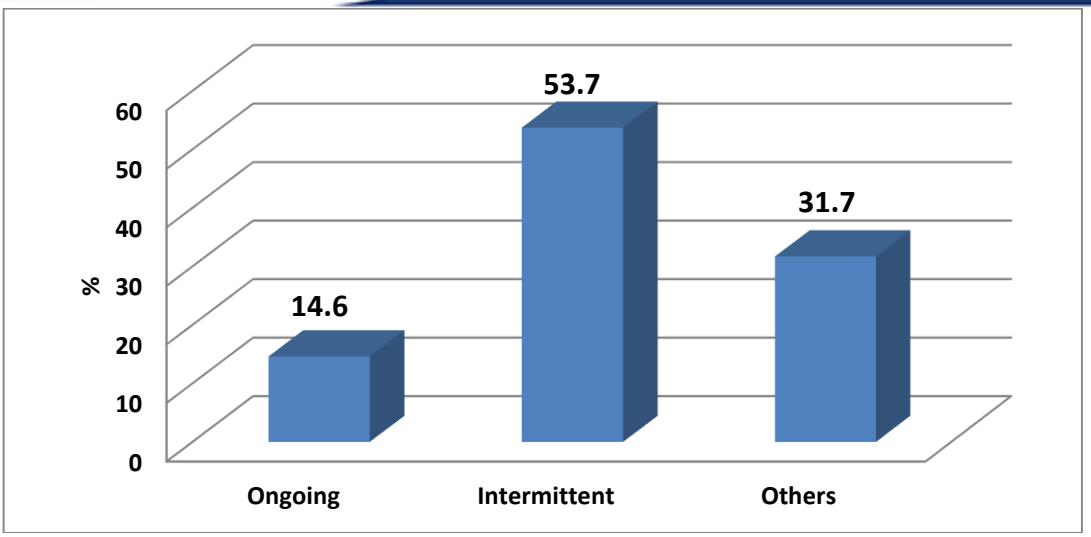

Fig.3. Distribution of type of noise hazards among participants (n=41)

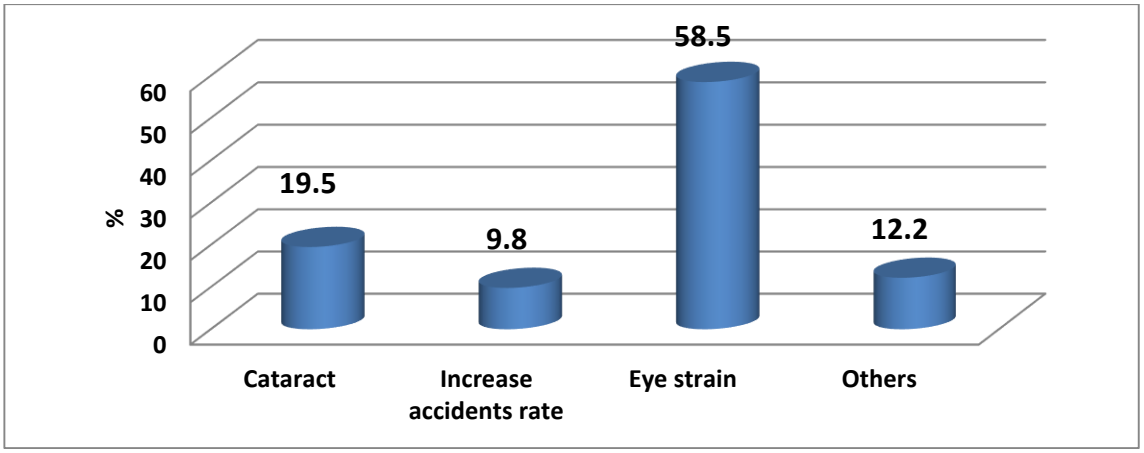

Fig.4. Distribution of type of lighting hazards among participants (n=41)

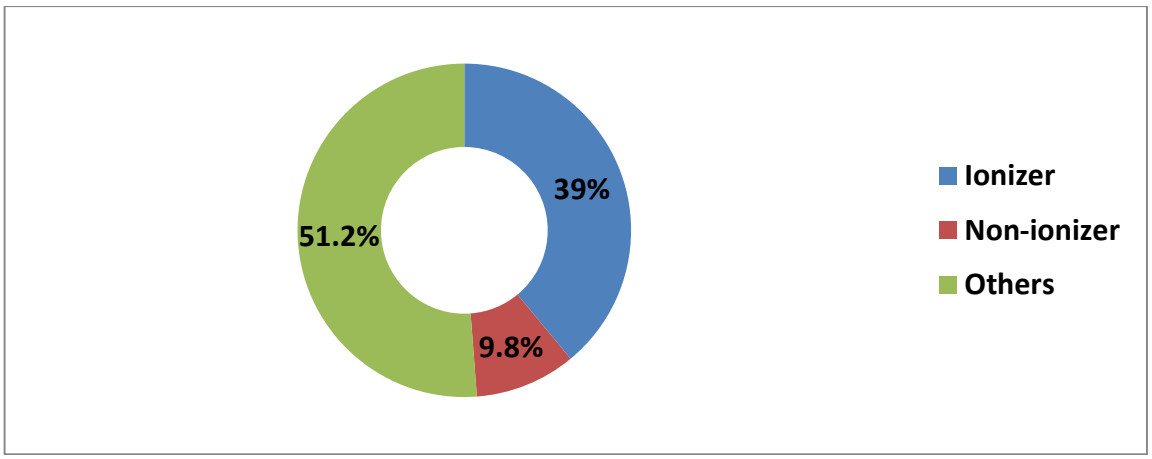

Fig.5. Distribution of type of radiation hazards among participants (n=41)

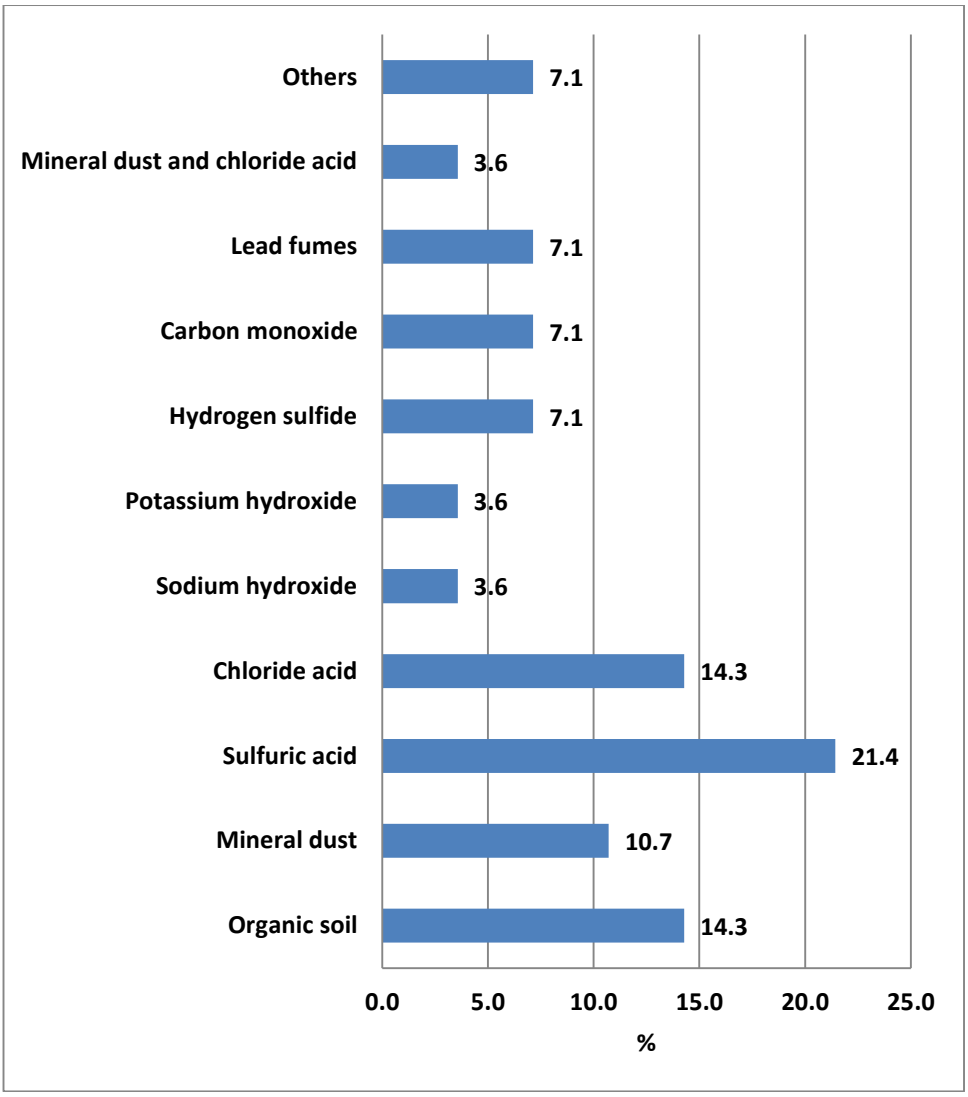

Fig.6. Distribution of type of chemical hazards among participants (n=28)

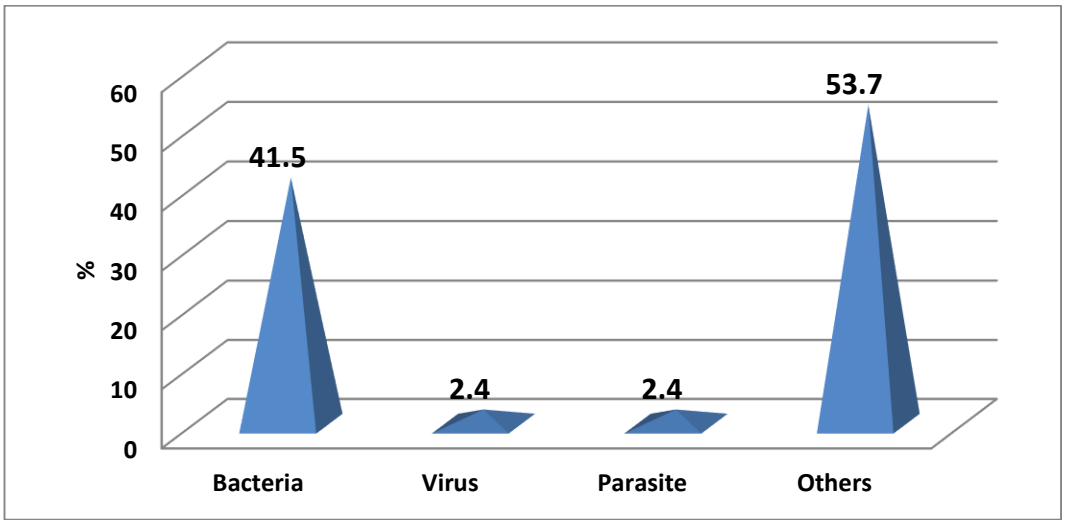

Fig.7. Distribution of type of biological hazards among participants (n=41)

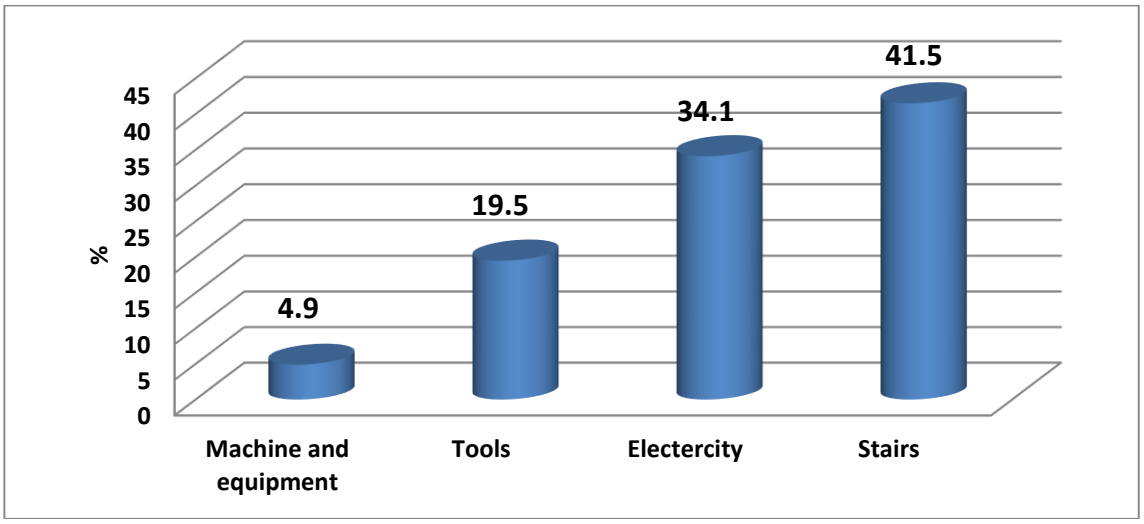

Fig.8. Distribution of type of mechanical hazards among participants (n=41)

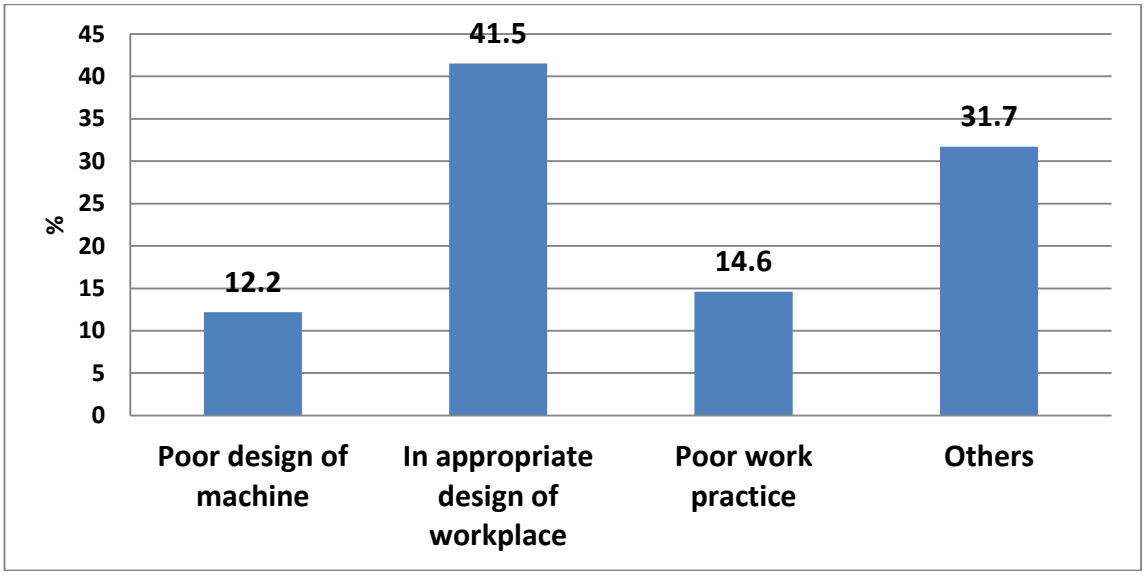

Fig.9. Distribution of type of Ergonomic hazards among participants (n=41)

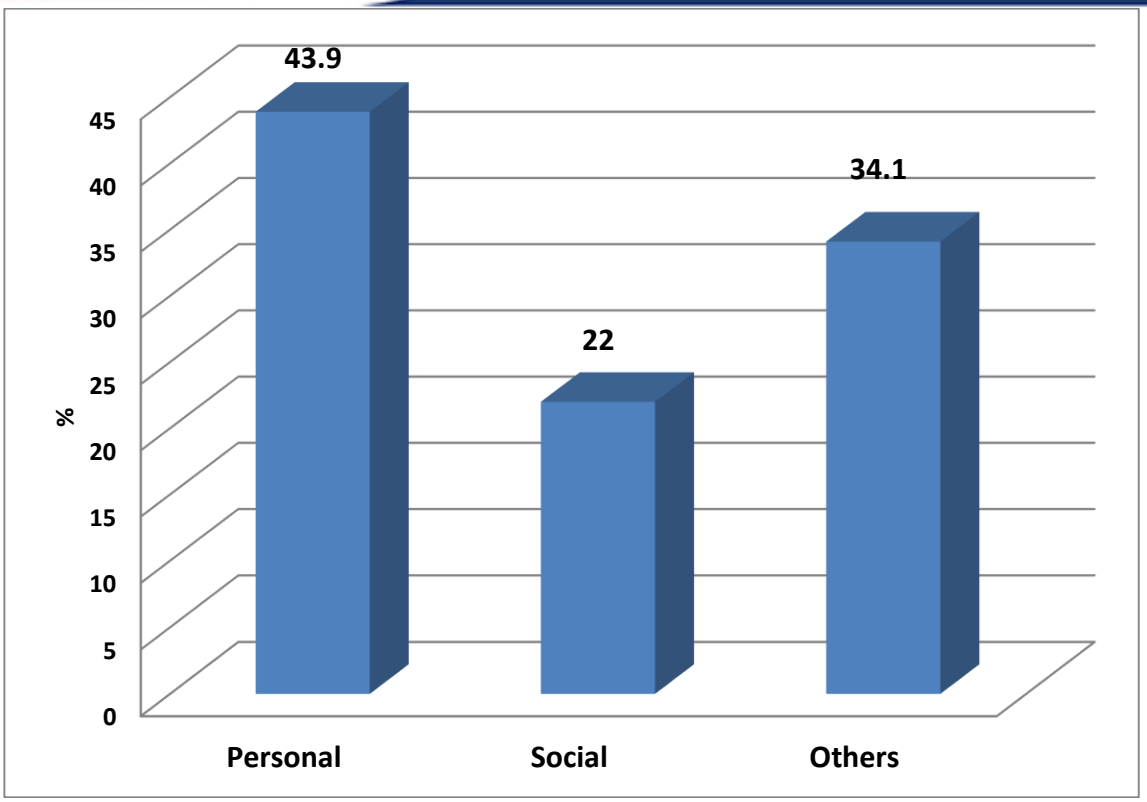

Fig.10. Distribution of type of psychological hazards among participants (n=41

Table 3. Person's correlation between workers' health risk exposure in medical laboratories and socio-demographic information

Exposure		Gender	Age	Education
Physical hazards	Pearson Correlation	.079	**.801(**)**	**.876(**)**
	Sig. (2-tailed)	.623	.000	.000
	N	41	41	41
Thermal hazards	Pearson Correlation	.111	**.834(**)**	**.910(**)**
	Sig. (2-tailed)	.488	.000	.000
	N	41	41	41
Noise hazards	Pearson Correlation	.079	**.801(**)**	**.876(**)**
	Sig. (2-tailed)	.623	.000	.000
	N	41	41	41
Lighting hazards	Pearson Correlation	.259	**.788(**)**	**.614(**)**
	Sig. (2-tailed)	.102	.000	.000
	N	41	41	41
Radiation hazards	Pearson Correlation	.222	**.813(**)**	**.851(**)**
	Sig. (2-tailed)	.163	.000	.000
	N	41	41	41
Chemical hazards	Pearson Correlation	.253	**.945(**)**	**.736(**)**

	Sig. (2-tailed)	.111	.000	.000
	N	41	41	41
Biological hazards	Pearson Correlation	**.324(*)**	**.646(**)**	**.715(**)**
	Sig. (2-tailed)	.039	.000	.000
	N	41	41	41
Psychological hazards	Pearson Correlation	.145	**.869(**)**	**.865(**)**
	Sig. (2-tailed)	.367	.000	.000
	N	41	41	41
Mechanical hazards	Pearson Correlation	.245	**.668(**)**	**.738(**)**
	Sig. (2-tailed)	.123	.000	.000
	N	41	41	41
Ergonomic hazards	Pearson Correlation	.293	**.893(**)**	**.695(**)**
	Sig. (2-tailed)	.063	.000	.000
	N	41	41	41

** Correlation is significant at the 0.05 level (2-tailed).*
*** Correlation is significant at the 0.01 level (2-tailed).*

Table 4. Person's correlation between workers' health risk type in medical laboratories and socio-demographic information

Hazard Type		Gender	Age	Education
Thermal	Pearson Correlation	**.323(*)**	**.897(**)**	**.873(**)**
	Sig. (2-tailed)	.039	.000	.000
	N	41	41	41
Noise	Pearson Correlation	**.321(*)**	**.931(**)**	**.827(**)**
	Sig. (2-tailed)	.040	.000	.000
	N	41	41	41
Lighting	Pearson Correlation	**.368(*)**	**.667(**)**	**.693(**)**
	Sig. (2-tailed)	.018	.000	.000
	N	41	41	41
Radiation	Pearson Correlation	.258	**.704(**)**	**.777(**)**
	Sig. (2-tailed)	.103	.000	.000
	N	41	41	41
Chemical	Pearson Correlation	.258	**.844(**)**	**.890(**)**
	Sig. (2-tailed)	.104	.000	.000
	N	41	41	41
Biological	Pearson Correlation	.251	**.683(**)**	**.755(**)**
	Sig. (2-tailed)	.114	.000	.000
	N	41	41	41
Psychological	Pearson	.255	**.890(**)**	**.837(**)**

	Correlation			
	Sig. (2-tailed)	.108	.000	.000
	N	41	41	41
Mechanical	Pearson Correlation	.274	**.799(**)**	**.914(**)**
	Sig. (2-tailed)	.083	.000	.000
	N	41	41	41
Ergonomic	Pearson Correlation	.209	**.937(**)**	**.906(**)**
	Sig. (2-tailed)	.189	.000	.000
	N	41	41	41

** Correlation is significant at the 0.05 level (2-tailed).*
*** Correlation is significant at the 0.01 level (2-tailed).*

Discussion:

This study aimed to assess the health risk exposures and their types among workers in the medical laboratory of Imam Al Mahdi University (White Nile State) during the period from October 2022 to March 2023. In this study, the majority of workers were male (70.7%) and female (29.3%). The results of this study are consistent with the findings of, (Tait, 2019). who found that of the 200 medical laboratory staff respondents, 51.5% were male and 48.5% were female. However, the findings of (Ndejjo et al., 2015) were not consistent with this finding, with (28.5%) male respondents and (71.5%) female respondents. This study aimed to determine the occupational health status of health staff, including laboratory staff, with respect to the hazards they face and to add hazard mitigation measures (Ndejjo et al., 2015).

In this study, 56.1% of the workers were between 26 and 33 years old. This result is comparable to the results regarding knowledge, attitudes, and practices regarding laboratory safety at the University of Port Harcourt Teaching Hospital in Nigeria, where the mean age of respondents was 35.3 years and SD was 8.8 years, and was representative of youth (Ejilemele & Ojulu, 2005).

In terms of education, more than half of the participants (51.2%) had a college degree. In contrast, most of the participants were found to be at the diploma level (43.80%). In addition, 56.1% of the workers in this study were exposed to physical hazards, while 70.7% were exposed to electrical-related hazards. This study aimed to assess the exposure of medical laboratory staff to physical hazards. The findings of this study differed from Tait's study (Tait, 2019) which focused on occupational health and safety conditions in a medical laboratory in Kajiado, Kenya.

The study by (Alshalani & Salama, 2019) found that laboratory staff were exposed to electrical hazards (92.9%), which was consistent with the present study which found that they were exposed to electrical hazards (26.32%). In the same study, (49.51%) of the laboratory equipment was placed in hazardous conditions, compared to (14.47%) in the present study.

The study by (Gestal, 1987) also reported that (23%) of medical laboratory staff were exposed to electrical related hazards.

In the present study, 23 workers, representing 56.1%, were exposed to noise hazards. This was lower than in another comparable study (Algarni, et al., 2023) which showed that medical laboratory staff were exposed to (9.31%) noise exposure.

In contrast, the biological hazard was 41.5%. However, about 41.5% reported exposure to other biological hazards such as bacteria, 2.4% to parasites, 2.4% to viruses, and 53.7% to protozoa. The findings in this study are similar to those of (Ndejjo et al., 2015) who focused on occupational hazards for medical staff, including laboratory staff, in Kampala, Uganda; in their findings, most respondents reported exposure to bacteria, at a rate of 39.5%. On the other hand, with regard to exposure to fungi and viruses, (Tait, 2019) reported 8% viral and 17% fungal, whereas in the present study, 22.02% were viral and 14.22% fungal.

At least 65.6% of respondents reported having been exposed to at least one type of biological harm. Eighty percent, 47%, 17%, and 8% of respondents indicated that they had been exposed to bacteria, parasites, fungi, and viruses, respectively. The high rate of exposure to bacteria is due to the fact that most of the bacterial habitats surrounding humans are present in the digestive system either as normal flora or as

infections (Tait et al., 2018). Furthermore, biological hazards are present in a variety of locations in the laboratory, including blood and body fluids, culture specimens, body tissues, cadavers, and other workers (Ejilemele & Ojulu, 2005).

Additionally, the study showed that 68.3% of medical laboratory workers were exposed to chemical hazards. The most common hazards were sulfuric acid (21.4%), chloride acid (14.3%), organic soil (14.3%), and mineral dust (10.7%); lead fumes (7.1%), carbon monoxide (7.1%), hydrogen sulfide (7.1%), potassium hydroxide (3.6%), sodium hydroxide (3.6%), mineral dust, chloride acid (3.6%), and others (7.1%). In contrast, the findings conducted by T(Tait, 2019). showed 15.2% exposure to flammable and combustible liquids and solids, while the participants in this study had 33% exposure to flammable and combustible liquids and solids.

Ergonomic hazards occurred among 70.7% of the workers in this study. The most common types of ergonomic hazards were due to proper workplace design (41.5%), improper work habits (14.6%), poor machine design (14.6%), and other (31.7%), whereas in a similar study by (Tait, 2019) Poor laboratory design was found in 39.7% of the study participants indicated that their laboratories were adequately designed, with 61% of the respondents indicating that their laboratories were adequately designed.

The study showed a positive correlation ($p<001$) between exposure to physical, thermal, noise, lighting, radiation, chemical, biological, psychological, mechanical, and ergonomic hazards and age group and education level. For correlation with gender, the only positive correlation was found between gender and exposure to biological hazards ($r2=.324$, $p=.039$). Positive correlations were also found between the type of physical, thermal, noise, lighting, radiation, chemical, biological, psychological, mechanical, and ergonomic hazards, age group, and education level ($p<001$). Thermal hazards ($r2=.323$, $p=.039$), noise ($r2=.321$, $p=.040$), and lighting ($r2=.368$, $p=.018$) were positively correlated with gender. On the other hand, a weak negative correlation ($r = -.043$) was found between gender and exposure to physical hazards, and a weak positive correlation ($r = .065$) between education level and presence of exposure to physical hazards at a significance level of .05. Health workers aged 19 to 30 had a higher reported exposure to all forms of physical hazards than higher, but further analysis showed a very weak correlation ($r = -0.084$) between age and exposure to physical hazards at the 0.05 level of significance. (Tait et al., 2018).

Age and exposure to bacteria ($r = -0.166$, significance level 0.05) and parasites (-0.157, significance level 0.01); education and exposure to bacteria ($r = 0.160$, significance level 0.05) (Tait et al., 2018).

Conclusions:

The study concluded that the worker hazards most commonly exposed in medical laboratories were lighting (75.6%), ergonomic hazards (70.7%), and chemical hazards (68.3%). The most common type of biological hazard was bacteria (41.5%), the most common type of chemical hazard was sulfuric acid (21.4%), the most common type of physical hazard was electrical-related hazard (70.7%), and the most common type of thermal hazard was heat stress (50%). The most common type of noise hazard was intermittent noise (53.7%), and the most common type of lighting hazard was eye strain (58.5%). The most common radiation hazard was ionizer (39%), and the most common chemical hazard was sulfuric acid (21.4%). However, stairs were the most common type of mechanical hazard (41.5%). The most common ergonomic hazard was proper workplace design (41.5%), and the most common psychological hazard was personal factors (43.9%). To increase awareness of medical laboratory personnel regarding health and safety procedures and to describe the hazards to which they are most likely to be exposed in order to prevent them. Conduct ongoing training on safety procedures and intensive courses for medical laboratory personnel to mitigate risks. Additionally, it is important to ensure the presence of safety equipment that makes medical laboratory practice safe.

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