Health Hazards among Radiographers

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Abstract

Background: Radiographers are exposed to certain chemicals which lead to some adverse health effects. Nevertheless, radiographers report many unexplained work-related symptoms attributed to dark room disease symptoms**. The aim of this study** was to assess health hazards among radiographers. **Research design**: A descriptive research design was utilized in this study. **Setting:** The study was conducted at the X-ray department affiliated to Benha University Hospital. **Sample:** Convenience sample of 70 radiographers was used in carrying out this study. **Tools:** Three tools were used; **Tool I:** A structured interviewing questionnaire to assess radiographers' socio-demographic characteristics. **Tool II:** Radiographer's knowledge about health problems such as headache, unexplained fatigue, sore throat, cough and runny eyes through the last three months. **Tool III:** Observational checklist to assess radiographers' practices about safety measures. **Results:** 64.3% of the studied radiographers suffered from headache, 14.3% of the studied radiographers had good total knowledge level, 32.9% of the studied radiographers had satisfactory practice level, and there was highly relation between total knowledge and practice ($p < 0.001$). **Conclusion:** There was a statistically positive correlation between total knowledge and total practices' level regarding health hazards. **Recommendation:** Health educational program for radiographers to enhance their knowledge and practices regarding prevention of health hazards.

Keywords: Radiographers, health hazards.

Introduction:

Radiographers known as radiologic technologists, diagnostic radiographers and medical radiation technologists are healthcare professionals who specialize in the imaging of human anatomy for the diagnosis and treatment of pathology. Radiology is a branch of medicine that uses imaging technology to diagnose and treat disease. Radiology may be divided into two different areas, diagnostic radiology and interventional radiology **(Kobos et al., 2022).**

Health hazards come from processing chemicals in the darkrooms such as chemical hazards as inhalation of chemical fumes (developer, fixer, and stop bath) can cause respiratory irritation, skin and eye burns, and allergic reactions (which is why proper ventilation and PPE are essential). Skin contact with chemicals can irritate or burn skin so wear gloves and aprons. For spills and splashes, follow safe handling and disposal procedures to minimize risks. Fire Hazards; Flammable chemicals (e.g., alcohol-based stop baths), store flammables safely and use appropriate fire safety measures and ensure proper maintenance and grounding to prevent overheating and potential sparking of chemical equipment. Physical hazards, ergonomics risk of musculoskeletal injuries can be due to repetitive lifting, carrying, and bending so practice proper lifting techniques and take breaks. Spills can create wet surfaces, therefore, maintain good housekeeping and wear slip-resistant shoes to prevent slips and falls **(Shettigar et al., 2025).**

Health complications are due to exposure to the chemicals used to develop and fix- x-ray film. The chemicals, which include developers, fixers, and stop baths, can contain a variety of harmful substances, such as: formaldehyde a known carcinogen that can irritate the skin, eyes, and respiratory system, hydroquinone a potential endocrine disruptor that can also cause skin irritation, acetic acid an irritant that can cause skin, eye, and respiratory tract irritation and glutaraldehyde a disinfectant that can cause respiratory problems, skin allergies, and asthma. Exposure to the chemicals can lead to a number of health problems, including skin problems skin rashes, burns, and dermatitis are common among radiographers who work in darkrooms. Respiratory problems due to inhalation of chemical fumes can irritate the lungs and airways, leading to coughing, wheezing, and shortness of breath. Eye problems due to chemical splashes can irritate the eyes and causes conjunctivitis cancer. Some of the chemicals used in darkrooms are known or suspected carcinogens **(Albander, 2021).**

Preventive measures and best practices to minimize the risk of developing dark room disease, it's crucial to implement effective preventive measures and follow best practices in darkroom environments. Recommendation for radiographers: adequate ventilation in clade, ensure proper ventilation in the darkroom to dilute and remove chemical fumes, install exhaust fans to draw out fumes directly from the source, regular maintenance: as to regularly clean and maintain ventilation systems to ensure optimal performance, personal protective equipment, such as gloves to protect the skin from direct contact with chemicals, masks or respirators to filter out airborne particles, fumes and eye protection to protect the eyes from splashes , fumes and protective clothing to minimize skin exposure **(Okeji et al., 2015).**

Community Health Nurses can collaborate with radiography departments to assess the safety and health standards of the darkrooms, ensuring they meet the necessary requirements to prevent disease onset (**Rodriguez, 2021).** Also, they can organize regular health screenings for radiographers to ensure early detection of symptoms related to darkroom diseases, thus facilitating early interventions (**Lee& Kim, 2022).**

Significance of the study:

According to research done at radiology department of Benha University Hospital, a total of 70 radiographers have experienced different symptoms of the dark room disease, 61.4% of the radiographers experienced headache while 24.3% of the radiographers suffered from unexplained fatigue. On the other hand, 95.7% of the radiographers never complained of skin rash. According to the Research Department of Benha University in radiology aspects, the most predominant health complaint addressed by radiographers were headache 98.7%, discomfort breathing 78.9%, eye symptoms 65.8 % and sneezing 63.2% during working hours mentioned in darkroom deficiency of quality control measures for darkroom processing **(Research Department of Benha University, 2022).**

Aim of the study:

This study aimed to assess health hazards among radiographers

Research questions:

1. What is radiographers' knowledge regarding health hazards?
2. What are radiographers' practices regarding health hazards?
3. Is there relation between radiographers' knowledge and their practices regarding health hazards?

Research design:

A descriptive research design was used to conduct this study.

Research setting:

The study was carried out at X-ray Department affiliated to Benha University Hospital. The radiology department is one of several departments located inside Benha University Hospital. The radiology department inside the Hospital is divided into two parts. One part is located inside the Outpatient Clinics and serves many patients who visit daily Outpatient Clinics. The other department is located inside the internal medicine building and saves the patients who are hesitant and detained within the Internal Medicine and Surgery Units in the Hospital.

Sampling:

Convenience sample was used in carrying out this study. All radiographers at X-ray department in Benha University Hospital. Radiographers who were working in a darkroom inside medicine Department included (70) radiographers.

Tools for data collected:

Three tools were used to collect the data:

Tool I: A structured interviewing questionnaire: concerned with socio – demographic characteristics of the studied radiographers which included 5 questions (age, sex, educational, qualifications, marital status, and residence).

Tool II: Concerned with radiographers' knowledge about health problems that appeared through last three months, it included 10 symptoms (headache, nausea, skin ulcer, skin ash, sore throat, runny eyes, sweat night, tinnitus and unexplained fatigue).

NB: Source of information question was not included in scoring system of knowledge.

Scoring system:

The scoring system for radiographers' knowledge about health problems was calculated as follows 1 point for suffering from health problems and 0 for not suffering from health problems, the score of the items was summed-up and the total divided by the number of the items, and converted into a present score. The radiographer suffered from a health problem if the score was >80% > 16, while they didn't suffer if the score was<80% <16.

Tool III: Concerned with radiographers' reported practices about prevention of health hazards:

Part I: Reported practices which included 4 items (maintain physical activities, nutrition, personal protection and dealing with risks).

Part II: Observational checklist of the radiographers' practices regarding to materials safety data and sheet safety material data sheet it means is a document that provides critical information about hazards associated with material that used in radiology filed this included chemical radioactive sources and other potentially risk items (product identification, hazards, identification, composition, information on ingredients, First aid measures. Safe handling and storage- exposure controls physical and chemical properties- stability and reactivity, toxicological information, ecological information, disposal considerations transport information, regulatory information's must be ensuring staff are trained on their proper use in radiology departments can significantly reduce the risks of accidents, injuries and illness associated with handling hazardous materials **(Sinclair, 1988).**

Scoring system:

The scoring system for radiographers' practice was calculated as follow 1 for done and 0 for not done. The score of the items was summed-up and the total divided by the number of items and converted into a present score.

If the score of total practices> 80% > 56 was considered satisfactory practice and score of total practices <80% <56 was considered unsatisfactory.

Content Validity:

The tools were reviewed by five of Faculty's Staff Nursing reliable from Community Health Nursing Department Benha University and gave their opinion for clarity, relevance, comprehensiveness; applicability and easiness for implementation and according to their opinion minor modification were carried out.

Reliability:

Reliability of the tools was done in cronbach's alpha, a coefficient test which revealed that each of the tools contested of relatively homogeneous items as indicative by the moderate to high reliability of each tool, the internal consistency of knowledge was 0.712 and the internal consistency of practice was 0.826.

Ethical and legal consideration:

The study was approved by Ethical Research Committee at Faculty of Nursing - Benha University. All the ethical consideration for radiographers in radiology unit was secured. The participants were informed about the purpose and benefits of the study. Their participation was voluntary and they have the right to withdrawal in the study without given any reason. In addition confidentiality and anonymity of the subjects were assured through coding of all data.

Pilot study:

A pilot study was done on 10% of the total study sample (9 radiographers) to test clarity and applicability of the study tools and to estimate the time needed to fill each tool. No radical modifications were done according to the results of pilot study. Participants were included in the total study sample.

Field work:

Data collection was carried out over about 3 months from the beginning of September (2023) till the end of November (2023). Radiographers' consent was obtained before collection of data. The researchers visited the radiology department of Benha University Hospital three days per week (Saturday, Sunday, and Monday) from 9 am to 12 pm to collect data from radiographers to assess their knowledge and practices. The average number of interviewed radiographers at the X-ray Department affiliated to Benha University Hospital was 2-3 radiographers/day. Each radiographer takes about 15-20 minutes to fill the sheet depending upon their understanding and responses to the interviews.

Statistical analysis:

The collected data were organized, categorized, analyzed, and presented in the form of tables and figures using the (SPSS) Statistical Package for Social Sciences, version ٢٢, which was used frequencies and percentages for qualitative descriptive data, chi-square coefficient X^2 was used for relation tests, mean and standard deviation was used for quantitative data.

Results:

Table (1): Shows that; 27.1% of the studied radiographers aged from 25 to less than 30 with mean and standard deviation was 33.82±7.11. 74.3% of them were male, 34.3% of them had nursing institute 65.7% of them were married. Regarding residence; 54.3% of them were lived in rural regions.

Table (2): Shows that; 61.4% of the studied radiographers always suffering from headache, 24.3% of the studied radiographers always suffering from unexplained fatigue, and 95.7% of the studied radiographers never suffered from skin rash, while 75.7% of the

studied radiographers sometimes suffered from nausea.

Figure (1): Illustrates that; 64.3% of the studied radiographers suffering from health problem, while 35.7% of them not suffering from health problem.

Figure (2): Illustrates that; 14.3% of the studied radiographers had good total knowledge level about health hazards while 47.1% of them had poor total knowledge level.

Table (3): Shows that; 38.6% of the studied radiographers reported that, they took a break during work periods, 100% of the studied radiographers reported that they avoided smoking, while 67.1% of the studied radiographers reported they stick with health nutrition.

Figure (3): Illustrates that; 32.9% of the studied radiographers had satisfactory total practices' level, while 67.1% of them had unsatisfactory total practices level.

Table (4): Clears that; there was highly statistically significant relation between the studied radiographers' total knowledge and total practices.

Table (1): Distribution of studied radiographers regarding their socio-demographic characteristics. (n=70)

Socio-demographic characteristics	No	%
Age/ years old		
<25	7	10.0
25-30	19	27.1
30-35	17	24.3
35- 40	11	15.7
40- 45	11	15.7
45and over	5	7.1
Sex		
Male	52	74.3
Female	18	25.7
Educational level		
Health technical institute	21	30.0
Intermediate university diploma	24	34.3
Bachelor's degree/higher education diploma	22	31.4
Postgraduate studies	3	4.3

Table (2): Distribution of studied radiographer regarding their health problems. (n=70)

Items	Health problems					
	Always		Sometimes		Never	
	No	%	No	%	No	%
Headache	43	61.4	13	18.6	14	20.0
Nausea	3	4.3	53	75.7	14	20.0
Skin ulcer	0	0.0	4	5.7	66	94.3
Skin rash	0	0.0	3	4.3	67	95.7
Sore throat	11	15.7	54	77.1	5	7.1
Runny eye	2	2.9	10	14.3	58	82.9
Cough	8	11.4	57	81.4	5	7.1
Night sweats	0	0.0	7	10.0	63	90.0
Ringing in the ear	2	2.9	10	14.3	58	82.9
Unexplained fatigue	17	24.3	28	40.0	25	35.7

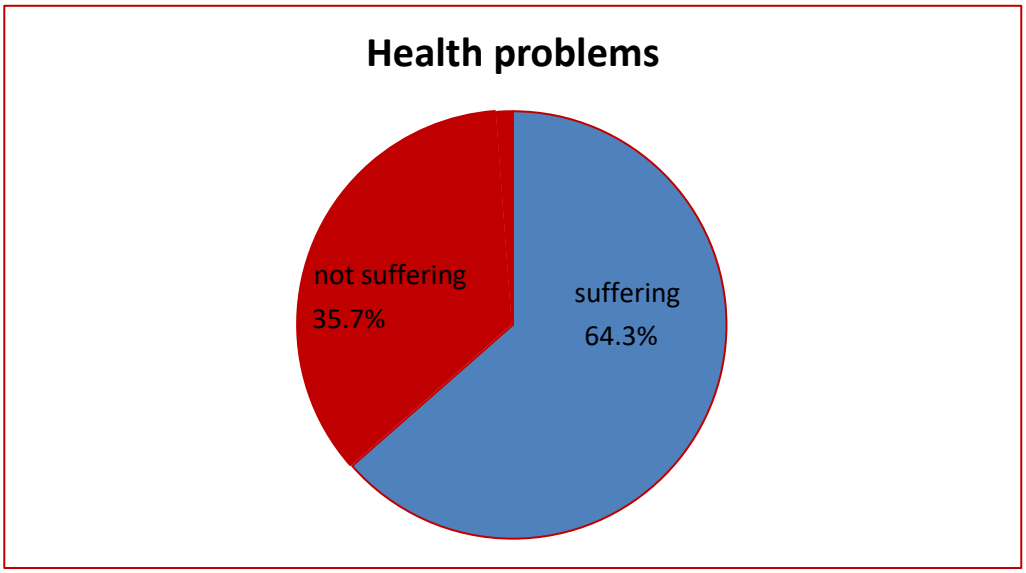

Figure (1): Percentage distribution of studied radiographer regarding their suffering of health problems. (n=70)

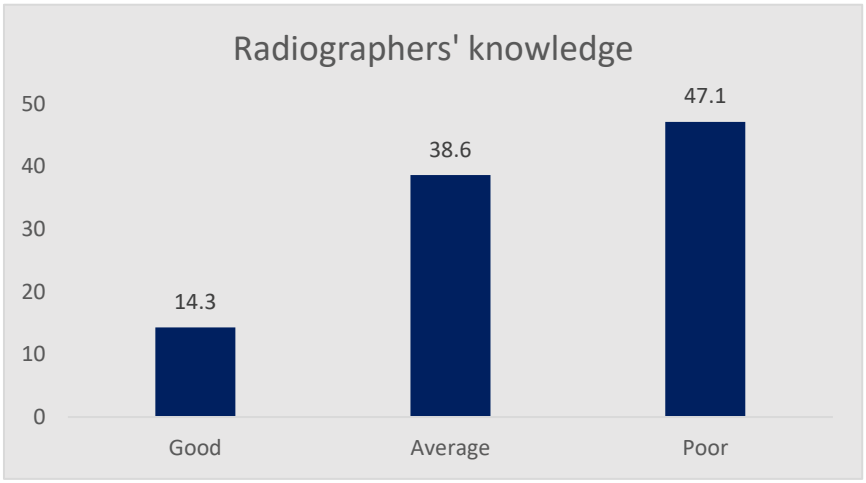

Figure (2): Percentage distribution of the studied radiographer regarding their total knowledge level about health hazards. (n=70)

Table (3): Distribution of studied radiographers regarding their general reported practices to prevent health hazards. (n=70)

Items	Practices			
	Done		Not done	
	No	%	No	%
Get enough sleep	14	20.0	56	80.0
Take a break during work periods	27	38.6	43	61.4
Exercise regularly	21	30.0	49	70.0
Avoid smoking	0	0.0	70	100.0
Use a personal dosimeter to monitor exposure to radiation	0	0.0	70	100.0
Stick with healthy nutrition	47	67.1	23	32.9
Deal with risks	23	32.9	47	67.1
Use protective measures	21	30.0	49	70.0

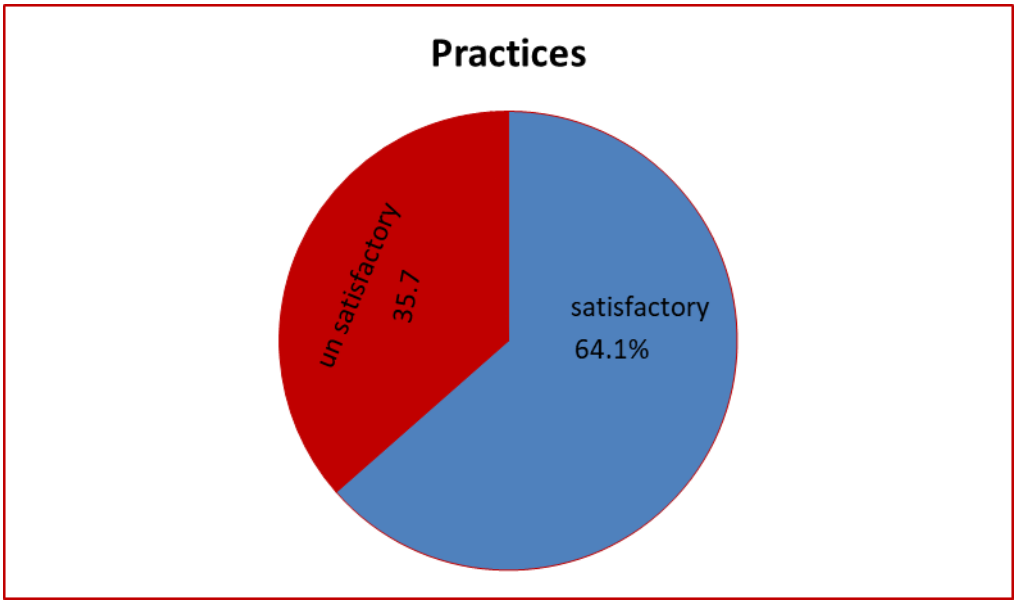

Figure (3): Percentage distribution of studied radiographers regarding their total practices level to prevent health hazards. (n=70)

Table (4): Correlation between total knowledge scores and practices among studied radiographers. (n=70)

Practices	Total knowledge	
total practices	r	
	0.523	0.031*

*** (P < 0.001) statistically significance.**

Discussion

Radiographers, as healthcare workers bears the brunt of all the workplace hazards and as well faced with the most significant impact of occupational hazard due to the risk of poor and inadequate diagnostic machines, and poor knowledge regarding infection prevention measures. Radiographers faces different types of hazards challenges when conducting routine examinations. These hazards range from physical, psychological, biological, ergonomic and chemical hazards. It is expected that radiographers should ensure standard infection control measures to prevent healthcare associated infections **(Leesi et al., 2024).**

Regarding socio-demographic characteristics of studied radiographers, the current study showed that; more than one quarter of the studied radiographers aged from 25 to less than 30 with mean and standard deviation was 33.82±7.11. More than two thirds of them were male; more than two thirds of them were married. Regarding residence; more than half of them were lived in rural regions and regarding education level, there were more than one third of them had nursing education.

The present study illustrated that; more than two thirds of the studied radiographers suffered from health problem, while more than one third of them did not suffer from health problems. More than half of the studied radiographers suffered from headache, more than sixth of the radiographers complained of sore throat. This might be due to that radiographers were the closest persons to the patients.

This finding was supported by **Eliwa et al., (2018)** they concluded that three fifths of radiographers had health problems related to exposure to radiation at work such as respiratory problems, sore throat, slightly more than two thirds of technicians had neurological problems, included headache, less than three fifths of radiographers had eye problems and more than two fifths of radiographers complained from gastrointestinal problems. In the same context, **Ebrahim et al., (2011)**, in Egypt, a study entitled "Compliance to Safety Measures toward Radiation Hazards among the Health Team" and found that more than two thirds of radiation health team complained from sore throat. Additionally, Consistent with the previous results a study carried out, by **Goodman (2016)** "Ionizing Radiation Effects and Their Risk to Humans" and emphasized that acute sickness as nausea, vomiting, sore throat and diarrhea developing within hours or minutes after being exposed to 2 Sievert dose of radiation in more than half of their studied sample.

The present study illustrated that; minority of the studied radiographers had good total knowledge level, while less than half of them had poor total knowledge level. This might be due to lack of training courses, which emphasized the urgent need for educational programs regarding health hazards among radiographers.

The result went in line with **Shokeen et al., (2022)** who studied "Assessment of Knowledge and Practices about Occupational Radiation Safety among Radiologic Technologists" in Palestine also reported insufficient hazard awareness among some radiographers. This study agrees with **Eliwa et al., (2018)** who studied "Occupational Health Hazards and Protective Measures among Radiation Health Team" and stated that 89.2%, majority of radiographers had unsatisfactory knowledge. On the same line, a study conducted in Kuwait by **Alotaibi et al., (2012)** entitled **"**Radiation Awareness Among Health Workers in Nuclear Medicine Departments" and found that majority of

radiation health workers had unsatisfactory knowledge

In contrast to the current study findings, **Zervides et al., (2020)** who studied "Assessing radiation protection knowledge in diagnostic radiography" in the Republic of Cyprus. A questionnaire survey" and showed that the levels of knowledge in radiation protection of radiographers in the Republic of Cyprus are of a good standard. Also, on the contrary, a study done in Nigeria by **Awosan et al., (2016)** who studied that "Knowledge of Radiation Hazards, Radiation Protection Practices and Clinical Profile of Health Workers in a Teaching Hospital in Northern Nigeria" and found that 59.1% of health workers had good knowledge of radiation hazards. This reflected the differences in the study setting.

The present study showed that; more than one third of the studied radiographers reported that they took a break during work. All of the studied radiographers reported that they avoided smoking and used a personal dosimeter to monitor exposure to radiation. This might be due to hospital supervise or provide these measurements at accurate time in addition give training courses to have this knowledge. The good practices could be attributed to adequate hazard awareness, safety strategies; training received, and accumulated experience on the job.

These results are in the same line with **Abd El-megeed et al., (2019)** "Practices of Radiographers regarding Occupational Hazards and Protective Measure" in Jordan who concluded that the majority of the studied radiographers were following these protection principles of time, distance and shielding to protect themselves. Moreover, these results are supported by **Saha, (2019),** who mentioned that; three basic strategies of radiation protection that include time, distance and shielding should be followed for dealing with radiation to minimize the external exposure or internal absorption of radiation and hence to reduce the odds of cancers.

The result is in agreement with **Khattab et al., (2022)** who studied "The prophylactic roles of dietary antioxidants for medical radiology workers: A mini-review. Natural Resources for Human Health" and reported that 83.5% of radiographers, more than three quarters had a suitable uptake of minerals, vitamins, and Combinations of dietary antioxidants through the daily diet and balanced it remains the promising approach without exceeding the uptakes doses that could reverse the positive effects of this approach.

The present study clarified that; more than two thirds of the studied radiographers reported that they revise the date on which chemical containers were opened regularly. Majority of the studied radiographers reported that they don't ensure that chemical containers are covered.

These results are compatible with **Chandramoorthy et al., (2020)** they studied "Healthcare workers' perspectives on Healthcare-Associated Wellbeing and Protective Measures: A video-reflexive ethnography study in the Asir region of Saudi Arabia" and concluded that radiographers should ensure their responsibilities towards their health should include upholding a safe work environment, choosing suitable risk management and hazard control measures, and using reduction or elimination methods that adhere to health and safety regulations. Also apply the right principles and applications of chemicals, sterilization and decontamination procedures, and the precautions suggested by WHO for

properly handling waste and spillage of chemicals.

The current study showed that; most of the studied radiographers reported that they ensure wearing the safety personal equipment. Less than two thirds of the radiographers complied with wearing eye protection glasses. On the other hand, more than third of the radiographers used to wear gloves. Also, more than two thirds of the radiographers used to wear thyroid protective aprons. More than three quarters of the studied radiographers reported they don't continue research on safety in radiology.

These results are identical with **Antunes-Raposo et al., (2022**) a study entitled "Evaluation of Personal Protective Equipment Use in Healthcare Workers Exposed to Ionizing Radiation in a Portuguese University Hospital" who mention that thyroid protectors had the highest compliance (61.7 and 55.6%, respectively). In addition to discomfort, the compliance with wearing lead glasses (8.1%) and gloves (0.7%) were very low. Moreover, this result in the same hand with **Sharma et al., (2016)** who studied "Evaluation of knowledge and Practice Towards Radiation Protection among Radiographers of Agra City" and found that; all radiographers were aware of use of personal protective measures.

The present study illustrated that; more than two thirds of the studied radiographers had satisfactory total practices' level, while more than three quarters of them had unsatisfactory total practices' level, this might be due to a lack of continuing professional development in the study areas and negligence of workshops. On the opposite side; the present result is incongruent with **Abdularazaq et al., (2024)** they studied "Radiographers Knowledge, Practice, and Compliance with Radiation Protection Measures in the Radiology Department" in Palestine and reported that their responses show good practice of radiation protection. Also, this result is incongruent with **Leesi et al., (2024)** who showed that more than half of the radiographers 130 (57.5%) had good practice.

Conclusion:

More than half of the studied radiographers always suffered from headache, more than sixth of the studied radiographers complained of sore throat. Less than third of the studied radiographers always suffered from unexplained fatigue. The minority of the studied radiographers had good total knowledge level, less than one third of the studied radiographers had satisfactory total practices' level. There were positive statistically significant correlations between the studied radiographers' total knowledge level and total practice level.

Recommendations:

1-Health education and should be encouraged to radiographers.

2-Establish website data base for all radiographers to recognize health problems and dealing with it.

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مخاطر الصحة بين فنيين الأشعة

عزة عربى محمد - ابتسام محمد عبد العال- سماح سعيد صبرى

يتعرض فنيو الأشعة لبعض المواد الكيميائية التي قد تؤدي إلى آثار صحية سلبية. ومع ذلك، أفاد فنيو الأشعة بالعديد من الأعراض غير المبررة المرتبطة بالعمل، والتي تُعزى إلى أعراض مرض الغرفة المظلمة. هدفت هذه الدراسة إلى تقييم المخاطر الصحية بين فنيي الأشعة. وتم استخدام تصميم بحث وصفي في هذه الدراسة. وقد أُجريت الدراسة في قسم الأشعة التابع لمستشفى جامعة بنها على عينة عشوائية من ٧٠ فني أشعة لإجراء هذه الدراسة. وقد اظهرت النتائج انه عانى ٦٤,٣٪ من فنيي الأشعة المدروسين من الصداع، وتمتع ١٤,٣٪ منهم بمستوى جيد من المعلومات ، و٣٢,٩٪ بمستوى مرضي من الممارسات، وكانت هناك علاقة وثيقة بين المعلومات الإجمالية والممارسات. واوصت الدراسة بتنفيذ برنامج تثقيف صحي لفنيى الأشعة لتعزيز معلوماتهم وممارساتهم فيما يتعلق بالوقاية من المخاطر الصحية.