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Knowledge and Attitude about Radiation Hazards on Pregnant Women Among Non-Healthcare Students in Universiti Sultan Zainal Abidin (UniSZA)

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Abstract

Lack of awareness of radiation exposure during pregnancy in Malaysia can lead to a higher possibility of rejection from pregnant women to undergo an examination using ionizing radiation. This study aims to assess the general knowledge and attitude regarding radiation hazards on pregnant women among students at Universiti Sultan Zainal Abidin (UniSZA). A cross-sectional study was conducted among non-healthcare students in UniSZA. A questionnaire was distributed online using Google Form to assess knowledge and attitude of radiation hazards on pregnant women. Descriptive statistics and an Independent T-test were used to determine the knowledge and attitude of the respondents. A total of 120 students have participated in this study. Equal sample sizes are obtained with 60 male students and 60 female students. The total mean knowledge and attitude score for all students is 1.31 and 4.13 respectively. The mean knowledge of female students (M=24.27) ($P < .05$) was higher compared to male students (M=20.20) ($P < .05$). Mean attitude of female students (M=17.40) ($P < .05$) was higher compared to male students (M=15.65) ($P < .05$). Female students have higher knowledge and attitude towards radiation hazards on pregnancy compared to male students. Lack of knowledge and attitude on radiation hazards in pregnancy can give serious effects in the future. Continuous awareness campaigns on the benefits and risks of radiation must be held through various platforms to educate people regarding the radiation hazards on pregnant women.

Keywords

Attitude, knowledge, hazards, pregnancy, radiation.

Introduction

Radiation is a sort of energy that flows through space as waves or particles, also known as radiant energy. Radiation can be either ionizing or non-ionizing[1]. To ionize or charge an atom, ionizing radiation uses high energy to remove electrons from its orbit. Non-ionizing radiation affects air, water, and living tissue, unlike ionizing radiation, which only affects atoms. When compared to X-rays and other forms of ionizing radiation, non-ionizing radiation does not have the ability to ionize atoms and molecules. Non-ionizing radiation can be used to heat an object[2]. For example, microwave radiation is used to quickly heat water and food in a microwave oven.

Radiation is also a form of energy transmission. For instance, energy transmission happens when the sun heats an individual, and that individual absorbs the radiant energy emitted by the sun[3]. The advancement of technology has led to exposure to electromagnetic fields (EMFs) from various sources, such as electrical

equipment, devices, advanced instruments, electrical wiring, and specialized gadgets, thus increasing the potential risk of radiation exposure to the general population. Among these technologies, the most used in our daily lives is the mobile phone, which is not only widespread but also the fastest-growing technology[4].

Ionizing radiation, often known as gamma rays and X-rays, is a form of energy created by atoms and transferred as electromagnetic waves, gamma rays or X-rays, or beta or alpha and neutrons. The radioactive decay that results from the spontaneous smashing of atoms is a form of ionizing radiation. Ionizing radiation carries energy into body tissue, which can disrupt molecular structure[5]. This energy transfer in living organisms has the capacity to disrupt or destroy cellular functions, cause fatal and nonfatal somatic cancer effects, and alter the genetic code of cells, also known as an inherited effect.

Most radiation exposure episodes, on the other hand, will not expose the fetus to levels that are likely to produce health impacts in people who are concerned about earlier radiation exposures that may have affected the fetus' development or raised their risk of genetic illnesses[6]. This is true for most diagnostic medical tests and occupational radiation exposures that do not exceed regulatory limits. However, there are times when an expecting mother and her doctor should be concerned. Radiation's potential effects on the developing fetus depend on the dose and stage of development. As a result, Malaysian regulations under the Nuclear License Act (Basic Safety Radiation Protection 2010) set dose limits for occupational and public exposure to the fetus (Act 304).

Due to a lack of knowledge about these issues, women often feel fearful when they have to undergo examinations that involve radiation. The lack of awareness programs about radiation in Malaysia is also considered a drawback, leading the community to increasingly develop a phobia of ionizing radiation known as radiophobia. This situation is upsetting because the role of medical imaging still needs to be prioritized to help diagnose a disease. However, such a mindset could create challenges for both patients and healthcare professionals, potentially causing delays in the diagnostic and treatment planning process. Besides, it can worsen the condition of patients if they hastily decide to avoid procedures and reject treatments. Therefore, this study aims to assess the level of knowledge and attitude regarding radiation hazards on pregnant women among students at Universiti Sultan Zainal Abidin (UniSZA).

Materials and Methods

Study design and participants

A questionnaire-based cross-sectional study was used to assess the knowledge and attitude about radiation hazards on pregnant women among non-healthcare students in UniSZA. All non-healthcare students at UniSZA aged 18 years old and above were invited to participate in this study. A consent form was included in the questionnaire to inform the participants about the study's purposes and guarantee the confidentiality of their information and willingness to participate.

Equipment and Materials

The questionnaire used in this study was adapted from two previous studies: Knowledge and Attitude about Radiation Effects on Pregnant Women among Medical Students[7] and Awareness of Hazards of Diagnostic Use of Radiation during Pregnancy among Women in Al-Madinah, KSA[8]. The questionnaire was distributed online using Google Form. The questionnaire was divided into three sections. The first section was the sociodemographic part (age, gender, education, and year of study). The second section consists of two multiple-choice answer questions, single one-choice answer question and five Likert questions. These eight questions evaluated the students' knowledge regarding radiation hazards on pregnant women. While the third section consists of four Likert questions that were used to evaluate the attitude regarding radiation hazards on pregnant women. All questions were required to be answered by respondents to avoid any missing data.

Ethical statement

The study protocol had been reviewed and granted ethical approval by University Sultan Zainal Abidin Human Research Ethics Committee (UHREC). This study had been assigned with study protocol code (UNISZA/UHREC/2022/417).

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Sampling and Sample Size Calculation

The sampling method that was used in this study was non-probability sampling, convenient and availability sampling. This sampling method relied on data collection from conveniently available respondents to participate in the study. A total of 120 students participated in this study. Stata MP 15.1 software was used to calculate the minimum required sample size for the reliability test.

Inclusion and Exclusion Criteria

The study's participants included male and female students from all faculties in Universiti Sultan Zainal Abidin, Kampus Gong Badak, 21300, Terengganu except for the Faculty of Health Science and Faculty of Medicine. An 18-year-old minimum age limit was set to ensure only eligible students were considered for admission. Mental illness, physical inability to respond, and/or no or restricted legal capacity, and age under 18, were all reasons for disqualification. Both genders were held to the same set of rules.

Reliability test

A reliability test was done among 34 students at Universiti Sultan Zainal Abidin (UniSZA). A Cronbach Alpha value of 0.75 was obtained from all the respondent data.

Data/Statistical analysis

All data were analysed using IBM-Statistical Package for the Social Sciences version 26. Descriptive statistic was used to assess the general knowledge and attitude regarding radiation hazards on pregnant women among students at Universiti Sultan Zainal Abidin (UniSZA). An independent T-test was used to compare the mean knowledge and attitude of radiation hazards on pregnant women between male and female students.

Results

A total of 120 students have participated in this study. There were 60 male and female students respectively. Based on Table 1, the majority group of ages were in the range of 18 years old to 23 years old (n=57, 47.5%). The respondents aged 41 years old and above were only 5.8% (n=7). All levels of education in UniSZA were involved in this study including Diploma, Undergraduate and Postgraduate. Most of the respondents (63%) involved in this study were from the undergraduate level while 14.2% (n=17) were from the diploma level. 30.8% (n= 37) and 31.7% (n=38) of the respondents were from Year 1 and Year 3 respectively, followed by respondents from Year 4 (21.7%) and Year 2 (15.8%).

Table 1: Sociodemographic of respondents

	Mean (SD)		Frequency (n)	%
Gender	0.5 (0.50)	Male	60	50.0
		Female	60	50.0
Age (years old)	0.95 (1.19)	18-23	57	47.5
		24-29	36	30.0
		30-35	10	8.3
		36-41	10	8.3
		41 and above	7	5.8
Educational level	1.08 (0.60)	Diploma	17	14.2
		Undergraduate	76	63.3
		Postgraduate	27	22.5
Year of Study	1.44 (1.14)	Year 1	37	30.8
		Year 2	19	15.8
		Year 3	38	31.7
		Year 4	26	21.7

Based on Table 2 below, most respondents (59%, n=71) received knowledge of radiation hazards during pregnancy through the Internet. 41% (n=50) knew that the fetus is most sensitive to radiation during the first trimester and only 30.8% (n=37) of the respondents answered ultrasound and magnetic resonance imaging (MRI) were safe to be used during pregnancy. 35.8% (n=43) of the respondents strongly agree that X-rays were destructive for pregnant women. Most respondents were neutral regarding whether radiation causes preterm and low birth weight in the fetus (37.5%, n=45).

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Regarding knowledge about the concept of the as low as reasonably achievable (ALARA) principle, most respondents (37.5%, n=45) only have basic knowledge about it. The mean knowledge regarding radiation hazards on pregnant women of females and male respondents was 24.3(±3.65) and 20.2(±3.88). It clearly shows that females have higher knowledge compared to male respondents. A significant difference (p=0.00) was shown between male and female respondents regarding the knowledge of radiation hazards on pregnant women.

Table 2: Knowledge regarding pregnancy and radiation

Questions	Frequency (n)	%
Where did you usually get a source of knowledge about radiation hazards during pregnancy?		
Internet	93	77.5
Hospitals	71	59.2
Relatives	20	16.7
Books	32	26.7
Never	10	8.3
Do you know about the period in which the fetus is most sensitive to radiation?		
First trimester	50	41.7
Second trimester	11	9.2
Third trimester	8	6.7
All pregnancy	51	42.5
Imaging modalities that can be safely done during pregnancy?		
Ultrasound	90	25.0
X-ray	13	10.8
Contrast Imaging	10	8.3
CT scan	15	12.5
MRI	43	35.8
Nuclear Imaging	6	5.0
Ultrasound & MRI (correct answer)	37	30.8
X-rays are destructive for pregnant women?		
Strongly disagree	3	2.5
Disagree	6	5.0
Neutral	25	20.8
Agree	43	35.8
Strongly agree	43	35.8
Radiation causes preterm birth and low birth weight in the fetus.		
Strongly disagree	2	1.7
Disagree	7	5.8
Neutral	45	37.5
Agree	43	35.8
Strongly agree	23	19.2
Knowledge about safe doses of radiation exposure?		
No knowledge	9	7.5
Minimal Knowledge	14	11.7
Basic Knowledge	59	49.2
Adequate Knowledge	29	24.2
Excellent Knowledge	9	7.5
Knowledge about the concept of the ALARA principle?		
No knowledge	13	10.8
Minimal Knowledge	15	12.5
Basic Knowledge	45	37.5
Adequate Knowledge	26	21.7

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Excellent Knowledge	21	17.5
Knowledge about safety methods during X-ray procedures like lead aprons and digital radiography?		
No knowledge	6	5.0
Minimal Knowledge	19	15.8
Basic Knowledge	42	35.0
Adequate Knowledge	27	22.5
Excellent Knowledge	26	21.7

According to Table 3 below, 35.8% (n=43) of the respondents strongly agree that X-rays should be avoided during pregnancy. Most respondents strongly agree (49.2%, n=59) that proper protection techniques must be applied when using radiation. Meanwhile, 48.3% (n=58) of the respondents strongly agree that awareness regarding radiation's effects on pregnant women among the public should be made through education and training. Nonetheless, 1.7% (n=2) of the respondents disagree with it. 4.2% (n=5) disagree and 36.7% (n=44) strongly agree about early exposure to radiation knowledge in school children, respectively.

The mean attitude was calculated based on question no.3 in Table 3 for the comparison between male and female students. The mean attitude of female and male students was 17.40 (±2.43) and 15.65 (±3.13), respectively. A significant difference (p=0.00) was also shown in attitude towards radiation hazards on pregnant women between male and female students. Based on the mean value, female students' attitude was higher than male students with a mean difference of 1.75.

Table 3: Attitude regarding pregnancy and radiation

Questions	Frequency (n)	%
Do you think X-rays should be avoided during the pregnancy?		
Strongly disagree	0	0
Disagree	7	5.8
Neutral	33	27.5
Agree	37	30.8
Strongly agree	43	35.8
X-rays should only be taken with proper protection techniques if highly necessary.		
Strongly disagree	1	0.8
Disagree	2	1.7
Neutral	26	21.7
Agree	32	26.7
Strongly agree	59	49.2
Education and training programs should be conducted to increase awareness among the public regarding radiation's effects on pregnant females.		
Strongly disagree	0	0
Disagree	2	1.7
Neutral	21	17.5
Agree	39	32.5
Strongly agree	58	48.3
Early exposure to radiation knowledge for school children		
Strongly disagree	0	0
Disagree	5	4.2
Neutral	26	21.7
Agree	45	37.5
Strongly agree	44	36.7

Knowledge and attitude about radiation hazards on pregnant women among non-healthcare students at UniSZA were determined through the mean value. The overall mean value for knowledge was 1.31 and 4.13 for attitude. According to the mean score interpretation knowledge and the attitude about radiation hazards on pregnant women of the respondents in this study was low and moderate, respectively.

Discussion

Radiation is hazardous even though it's beneficial in diagnosing the disease. Therefore, every treatment that uses radiation must be justified. ALARA principle should be followed to minimise its hazard. The benefits and risks of the examination should be considered before each examination especially when involving pregnant women. Good knowledge and attitude towards radiation can increase awareness and prevent unnecessary radiation exposure. In this study, the respondents chose the internet to seek knowledge about radiation and its hazards. The internet is the best platform for finding information, as it is easily accessible everywhere. Furthermore, students prefer searching for information online rather than going to the library.

Based on the mean value, respondents' knowledge in this study about radiation hazards on pregnant women was low. The results showed that most respondents answered fetus was sensitive to radiation throughout all trimesters. This misconception can lead to misdiagnosis in pregnant women who need X-ray examination during pregnancy[9]. It is because, in the early phases of pregnancy, certain tissues and organs are highly vulnerable to any sources of radiation. Eight to 15 weeks following conception, the fetus may be extremely radiosensitive[10]. All radiation exposure to pregnant or potentially pregnant women must be justified. Women need to inform the physician if they are pregnant or think they might be pregnant to justify the medical decision such as an X-rays examination and drug prescriptions.

The effect of radiation depends on the radiation dose given. Basic Safety Radiation Protection (BSRP) 2010 under Atomic Energy Licensing Act (Act 304) had enacted the dose limit for occupational and public exposure to fetus. The fetal dosage limit should not exceed 1 mSv per year. Moreover, the 28-day regulations were established as a guideline to reduce exposure to human embryo and fetus which are particularly sensitive to ionizing radiation. However, most of this study's respondents only possess basic knowledge about the safe radiation dosage during pregnancy. Besides, their knowledge of the ALARA concept and safety precautions used during X-ray procedures was at the primary level.

The ALARA concept was the basic principle of radiation protection. Focusing on the ALARA concept, a comparison was made between male and female students to assess their knowledge of radiation hazards in pregnancy. Female students have higher knowledge compared to male students. This condition might be because of the lack of exposure to this topic and the lack of interest in the male community. Unlike men, Women tend to be more attentive to healthcare and always seek knowledge about it. One of the awareness campaigns was breast cancer awareness which uses mammograms as a screening tool. Indirectly, by attending these kinds of programs they got some basic knowledge about radiation as mammogram examinations use ionizing radiation[11] Besides, pregnancy was valuable for every woman which makes them seek more knowledge compared to men to protect their baby throughout the pregnancy[12].

Knowing the benefits and risks of radiation could lead to a better diagnosis. However, poor knowledge could lead to poor diagnosis and treatment. As demonstrated by the findings of Arslanoglu et al. (2007), doctors, including interns, often underestimate the radiation doses patients receive during diagnostic procedures[13]. This underestimation leads doctors to request radiological examinations more often than is necessary, thereby increasing the risk of unnecessary radiation exposure for patients. A few other studies also indicated the lack of knowledge among healthcare professionals on radiation exposure and risk to pregnant women[14,15]. Therefore, healthcare professionals engaged in medical imaging services, such as physicians, radiographers, and radiologists, should possess sound knowledge, adhere to best practices, and maintain a responsible attitude to inform patients about the benefits and risks of radiation. This is because the public tends not to be concerned about ionizing radiation from medical procedures, mainly due to their confidence in doctors and the thorough training doctors receive in radiation safety[16].

Furthermore, it is clearly shown in this study that most respondents strongly agree that X-rays should be avoided during pregnancy, even though they strongly agree that precautions should be taken during X-ray examinations or any radiation procedures. To overcome this misconception, education and training

programs should be conducted more frequently to increase knowledge and awareness regarding radiation's effects, especially on pregnant women. Both female and male students in this study were agreed that education and training program needs to be increased. It aligns with a previous study demonstrating the importance of awareness of radiation exposure in pregnancy to pregnant women and healthcare practitioners[17]. This showed that they have a good attitude and were concerned about the community's lack of awareness about radiation risk, which can be a severe concern for the future[1]. The lesser difference in attitude level between male and female students compared to the mean difference in knowledge also indicated that the younger generation nowadays had started to be exposed more to this crucial information that leads to good practice in the future[8] and increased radiation awareness in public. The

Limitation of Study

This study was a cross-sectional study relying on questionnaires, with data collection predominantly conducted online. This approach led to ineffective communication with the participants, subsequently diminishing their enthusiasm and active engagement during the questionnaire completion. Consequently, participants tended to select answers randomly from the provided options, potentially influencing the study's outcomes. Furthermore, the study's ability to generalize its findings to a broader population may be limited due to the exclusive focus on students from a single university.

Conclusion

In conclusion, female students have higher knowledge and attitudes regarding radiation hazards than males. However, both genders should have good knowledge regarding radiation hazards during pregnancy to encourage pregnant mothers to undergo a diagnostic procedure if required under safe dose limitations that help provide a proper and more efficient diagnosis. Besides, it can prevent complications and reduce the mortality rate. Continuous awareness campaigns about pregnancy and radiation need to be done to educate the public about the benefits of radiation and its hazards especially for pregnant women. Therefore, the study findings could assist healthcare providers in designing an educational campaign and awareness program to overcome the misconception of the benefits and risks of radiation on pregnant women. Future studies can be done by improving the data collection method and study participants by collaborating with healthcare facilities, universities, and communities, which can increase the external validity and generalizability of the findings.

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Conflict of Interest Disclosure

None to declare.

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