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Awareness of the Benefits, Hazards and Protection from Different Types of Medical Radiation among Population in Najran Region

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Summary

A cross-sectional study was carried out, aiming to assess the awareness of benefits, hazards and protection methods of different types of medical radiation among Najran population. Electronic questionnaire was used to collect data. It contains personal data including gender, age, and, education. It contains also, data about awareness of different types of medical radiation devices and their benefits in diagnosis and treatment as well as awareness of hazards. What reasons that make people afraid from radiation and if there is an objection to work or to allow relatives to study or work in that field and the use of protective methods against medical radiation is also included. The total sample size of the study was 483 after exclusion of medical field workers and illiterates. Data were analyzed using SSPS 22. Results showed poor knowledge in relation to the use of medical radiation where 51.8% said that medical radiation is used to diagnose diseases and 47% stated that it is used for both diagnosis and treatment. Also, 94.6% believed that medical radiation could be risky to pregnant women. The MRI was the most important in that respect. They afraid from cancer and birth defects (32% for each) followed by infertility where significantly (P=0.029) more men than women were afraid. The health workers were the main source of knowledge of men (P= 0.042). Though none significant more women than men lack information about MRI contraindication.

Ways for protection against medical radiation; no gender differences were observed regarding avoid entering the examination room (P =0.238), Preferring a small dose of X-rays (P =1.000), and none exposure to any radiation (p = 0.738) as well as Covering the sensitive parts of the body by lead clothing (P = 0.174) and wearing thick clothes (P = 0.873).

Introduction

Radiation is a type of dangerous and powerful energy which is the emission or transmission of the form of waves or particles through space or a material medium. [1] It includes: electromagnetic radiation as X-ray or particle radiation such as alpha radiation or acoustic radiation such as ultrasound or gravitational radiation.
It is often classified as either ionizing or non - ionizing depending on the energy of the radiated particles [2].The use of radiation in medicine has been an important tool in diagnosing and treating patients for over a century[3].
Medical imaging procedures, nowadays involving the use of ionizing radiation are used daily in hospitals, making possible more accurate diagnosis of diseases and treatment [4]**.**
Despite the fact that medical imaging has many benefits, there are associated risks of radiation and growing concern over ionizing radiation and its adverse effects on humans [5].
In Saudi Arabia, many studies assessed awareness on radiation hazards among medical students and health care personnel[6]. Studies regarding the community awareness of risk of medical radiation and its benefits are few and almost nonexistent.

Objectives:

- Compare the awareness between males and females regarding the benefits and hazards of radiation.
- Clarifying the most common reasons that would make people feel afraid of radiation.
- Assess of public knowledge according to radiation during pregnancy.
- Reveal population awareness regarding radiation protection.

Person and Method

The cross-sectional study is the study design selected. The target population was persons living in Najran city. Data were collected through an electronic questionnaire where 800 questionnaires were distributed using whatsapp and twitter. The questionnaire included first the socio-demographic data (gender, age, educational level) second awareness of different types of medical radiation devices and its benefits in diagnosis and treatment. Third awareness of hazards and the reasons that make people feel afraid from radiation like cancer, infertility, fourth general conviction of medical radiology, and if there is an objection to allow relatives or acquaintances to study or work in this field; moreover, the use of protection methods from medical radiation. Data were analyzed using the Statistical Package for the Social Sciences (SPSS 22).

Results:

Of the total 800 questionnaires distributed 615 were retrieved with a response rate of 77%. Persons working in the Medical field (n=129) and (n=3) illiterate persons were excluded from the study, to reach a final sample size of 483 persons of them 171(35%) were men, and 312(65%) were women.

Both table (1) and figure (1) show the age and education of participants.

Age:

It is noticed that, of the total sample (n=483); 37.7% were in the age group 20-29 years old and 35.4% were from 30 to39 years of age those who were 40 years or older were about one quarter (24%) and the least were less than 19 years old.

Women were more than doubled the men in the age group 20 to29 years old (46.5% compared to 21.6%). In contrast, Men aged between 30 to 39 years old and those aged 40 years or more were more than women (40.9% and 35.1% compared to 32.4% and 14.9% respectively). Few women below 19 years old were also little more than men (3.2% compared to 2.3%). The differences are statistically significant (p =0.000).

Education level:

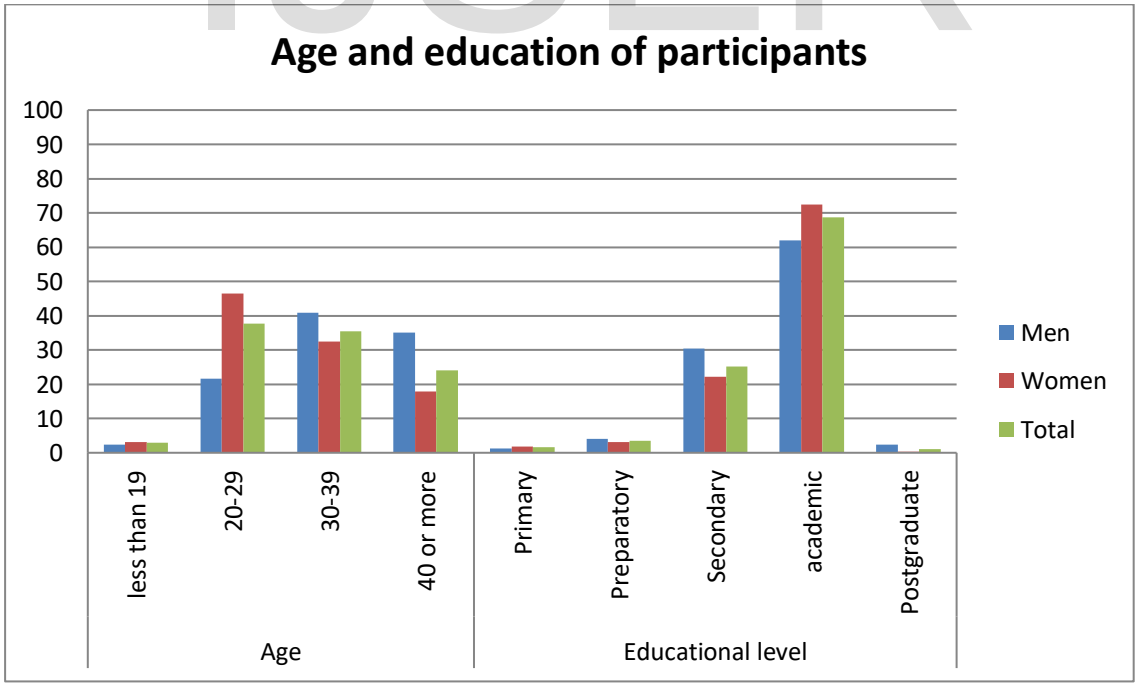
It was observed that a little more than two-thirds (68.7%) were holding a university educational certificate, one quarter (25.1%) holding a secondary, and 3.5% a Preparatory educational certificate, only 1.7% were holding a primary certificate and the least (1%) were holding a postgraduate educational certificate. More women than men were holding a university educational certificate (72.4% compared to 62%) or a primary educational certificate (1.9 %compared to 1.2%) On other hand, more men than women were holding a secondary educational certificate (30.4% compared to 22.1%), a preparatory certificate (4.1% compared to 3. 2%) or a postgraduate educational certificate (2.3% compared to 0.3%). The differences are statistically significant where P= 0.045

Table (1): Distribution of participants according to their age and education

Age and education of participants		Men (n=171)		Women (n=312)		Total (483)		P-value
		No.	%	No	%	No.	%	
Age in years	less than 19	4	2.3	10	3.2	14	2.9	0.000**
	20-29	37	21.6	145	46.5	182	37.7	
	30-39	70	40.9	101	32.4	171	35.4	
	40 or more	60	35.1	56	17.9	116	24.0	
Educational level	Primary	2	1.2	6	1.9	8	1.7	0.045*
	Preparatory	7	4.1	10	3.2	17	3.5	
	Secondary	52	30.4	69	22.1	121	25.1	
	University	106	62.0	226	72.4	332	68.7	
	Postgraduate	4	2.3	1	0.3	5	1.0	

*Chi-squared test: *Significant at 0.05 **Significant at 0.01*

Figure (1): Age and educational characteristics of the participants.



Knowledge and practice about medical Radiation:

There is no significant difference between men and women regarding being investigated by any type of medical radiology (P=0.112), knowledge about damage of medical radiation (P=114) and, think that the risk and radiation effect are equal regardless of the source and device used (P=0.140), as well as knowledge that exposure to medical radiation is a risk to pregnancy (P=0.402) and agreed to work (or any of relatives) in medical radiology department (P=0.129), or Knew that there are techniques or methods to protect from medical radiation (P= 190). However, significantly (P= 0.014) more women than men (89.7% compared to 81.9%) thought that MRI may prevent some patients from using it. (Table 2)

Table (2): Distribution of participants according to their Knowledge and practice about medical Radiation

Knowledge and practice about medical radiation		Men		Women		Total		P-value
		No.	%	No.	%	No.	%	
Have ever investigated by any type of medical radiation	**Yes**	115	67.3	187	59.9	302	62.5	0.112
	No	56	32.7	125	40.1	181	37.5	
Have knowledge about medical radiation damage	**Yes**	142	83.0	240	76.9	382	79.1	0.114
	No	29	17.0	72	23.1	101	20.9	
The risk and radiation effect are equal regardless of the source and device used	**Yes**	30	17.5	77	24.7	107	22.2	0.140
	No	87	50.9	135	43.3	222	46.0	
	I don't know	54	31.6	100	32.1	154	31.9	
Exposure to medical radiation is a risk to pregnancy	**Yes**	160	93.6	297	95.2	457	94.6	0.402
	No	6	3.5	5	1.6	11	2.3	
	I don't know	5	2.9	10	3.2	15	3.1	
MRI may prevent some patients from using it	**Yes**	140	81.9	280	89.7	420	87.0	0.014*
	No	31	18.1	32	10.3	63	13.0	

Agree to work (or any of your relatives) in medical radiology department	**Yes I agree**	113	66.1	182	58.3	295	61.1	0.129
	No, there are other important specialties	21	12.3	41	13.1	62	12.8	
	No, because it is harmful	33	19.3	86	27.6	119	24.6	
	No, for other reasons	4	2.3	3	1.0	7	1.6	
Techniques or methods to protect from medical radiation	**Yes**	74	43.3	116	37.2	190	39.3	0.190
	No	97	56.7	196	62.8	293	60.7	

Participants' knowledge of the uses of medical radiology:

No significant difference was observed between men and women regarding the use of medical radiation in diagnosis, treatment, or both of them (P=0.180). Table (3)

Table (3): Distribution of the participants' according to their knowledge on the uses of medical radiology

Participants own View	Men		Women		Total		P-value
	No.	%	No.	%	No.	%	
Diagnosis of Disease	88	51.5	162	51.9	250	51.8	0.180
Treatment of diseases	0	0.0	6	1.9	6	1.2	
both of them	83	48.5	144	46.2	227	47.0	
Total	171	100.0	312	100.0	483	100.0	

**Chi-squared test.*

Fears from exposure to medical radiation

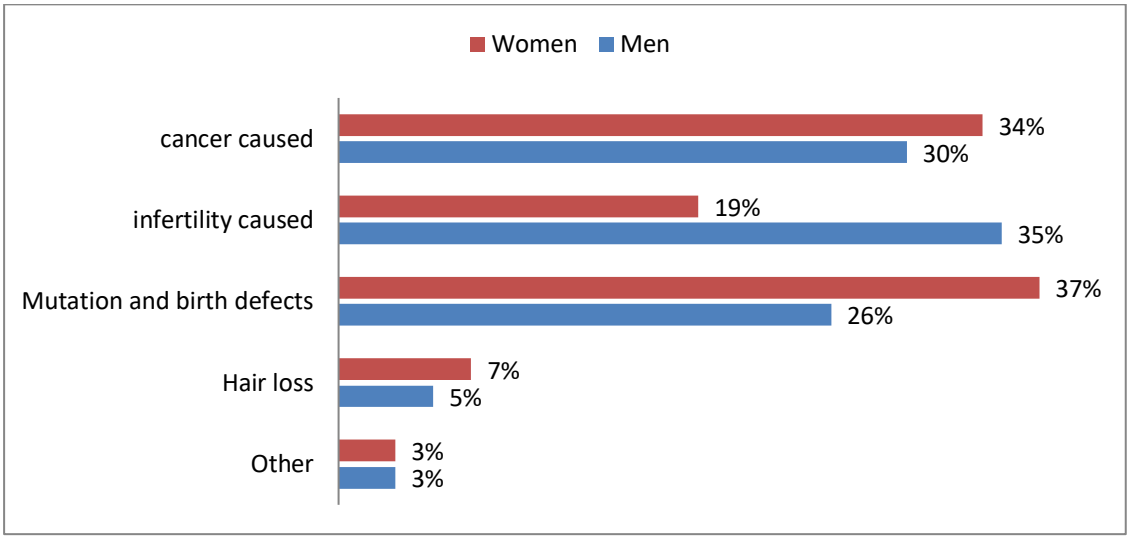
Table (4) and figure (2) show that the most important fears were cancer and birth defect (32% each) followed by infertility (26%), few (6%) were afraid from hair loss and 4% were afraid from others as decrease human immunity and bone pain. Only a significant difference (P = 0.029) is observed between men and women where more men (35%) than women (19%) were afraid from infertility.

Table (4): Distribution of participants according to fears from exposure to medical radiation

Fears from radiations	Men		Women		Total		P-vale
	No.	%	No.	%	No.	%	
cancer	134	30%	187	34%	321	32 %	0.617
Infertility	155	35%	102	19%	257	26 %	0.029*
birth defects	115	26%	202	37%	317	32 %	0.166
Hair loss	23	5%	36	7%	59	6%	0.564
Others	17	4%	19	3%	36	4%	1.000

**Significant at 0.05*

Figure 2: Distribution of participants according to fears from exposure to medical radiation.



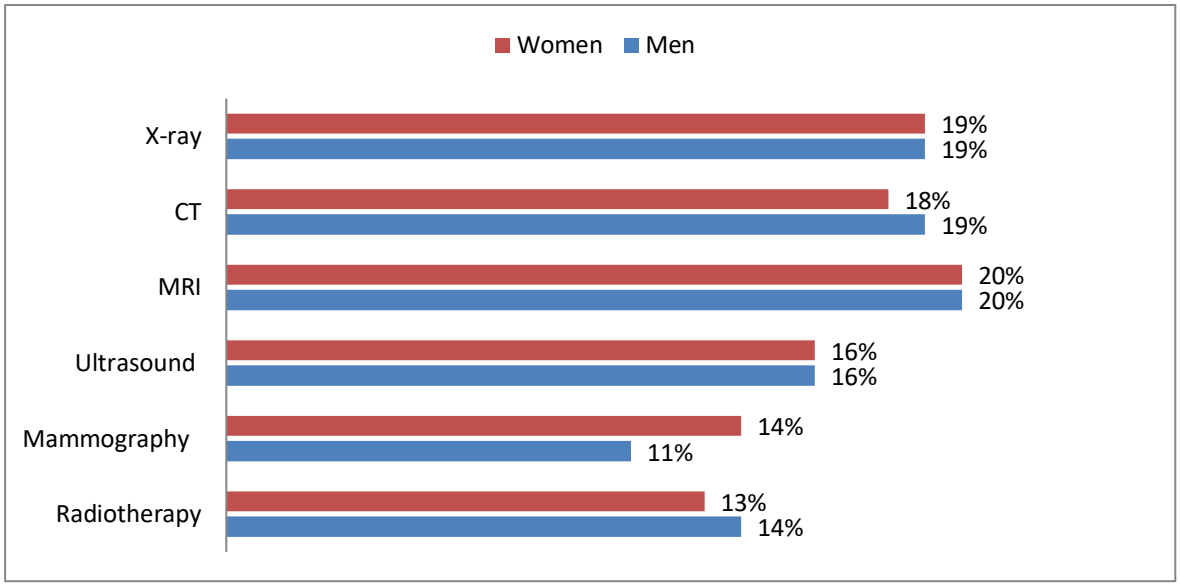
Knowledge of Medical Radiation devices:

It was noticed that the known equipment and techniques used are MRI (20%), X-ray (19%), and CT (18 %) as well as ultra sound (16%) followed by mammography and radiation therapy (13%) each. No significant statistical difference observed between men and women in this regard. Table (5) and figure (3).

Table (5): knowledge of participants about equipment and techniques used

Medical radiation devices	Men		Women		Total		P-vale
	No.	%	No.	%	No.	%	
X-ray	214	19%	283	19%	497	19%	1.000
CT	210	19%	265	18%	475	18%	0.869
MRI	222	20%	297	20%	519	20%	1.000
Ultrasound / Sonar	182	16%	234	16%	416	16%	1.000
Mammography	121	11%	203	14%	324	13%	0.549
Radiation therapy	158	14%	188	13%	346	13%	0.847

Figure (3): knowledge of participants about equipment and techniques used



Sources of knowledge about medical radiation damage

The important sources of knowledge of medical radiation hazards and damage were health workers (30%), social media (23%), and mass media (17%) as well as parents and relatives (17%). Other sources were book, courses and medical publication constituted only 4%. Those who did not know were 10%.

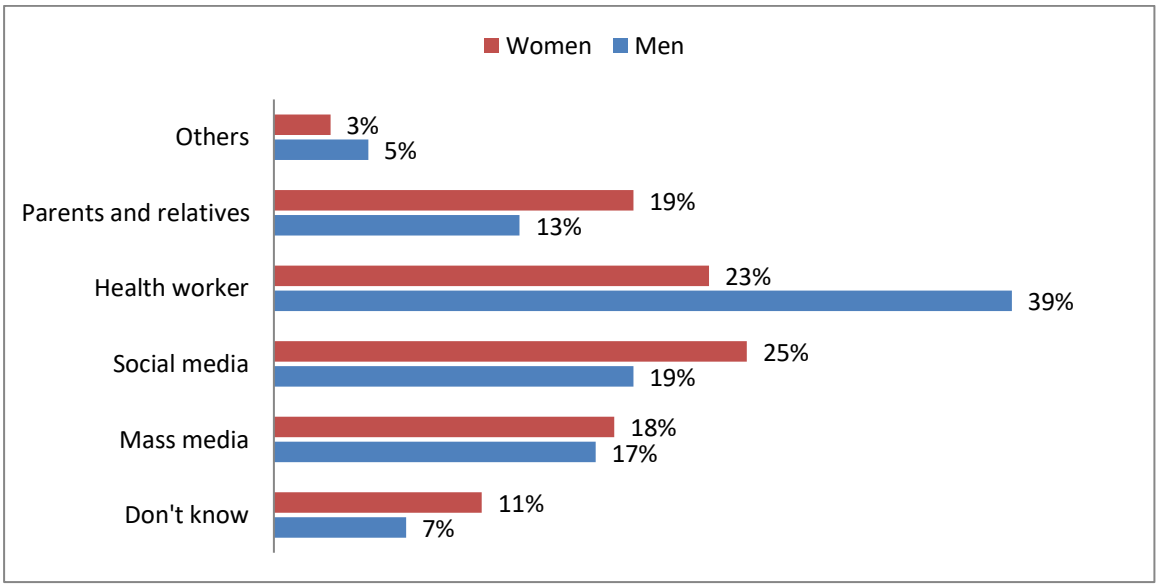
The health workers were the main source of knowledge of men than women (40% compared to 23%) the difference is statistically significant (P= 0.042). Table (6) and figure (4).

Table (6): Sources of knowledge of medical radiation damage

Source of knowledge	Men		Women		Total		P-vale
	No.	%	No.	%	No.	%	
Mass media	62	17 %	96	18%	158	17%	0.866
Social media	71	20 %	138	25%	209	23%	0.366
Health worker	146	40 %	127	23%	273	30%	0.042*
Parents and relatives	47	13 %	105	19%	152	17%	0.289
Others	13	4%	20	4%	33	4%	0.480
Don't know	25	7%	62	11%	87	10%	0.346

**Significant at 0.05*

Figure (4): Sources of knowledge about medical radiation damage



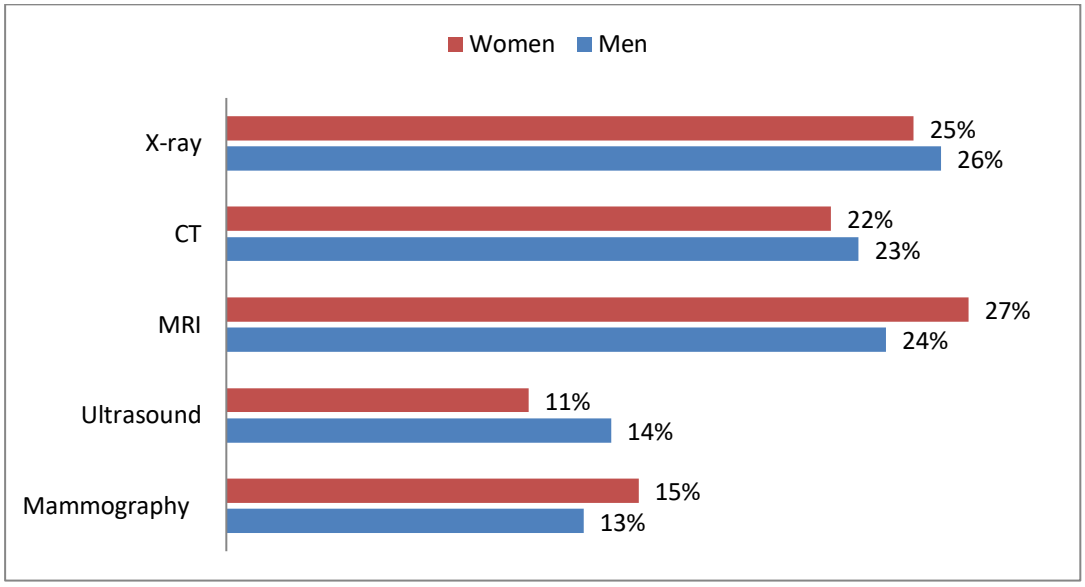
Types of medical radiation affecting pregnancy

Table (7) and figure (5) show the most important types of medical radiation affecting pregnancy according to participants' knowledge. It is clear that the most important were MRI and X- ray (26% for each) followed by CT (22%) and lastly, mammography and ultrasound (14% and 12% respectively). No significant difference is observed between men and women.

Table (7): types of medical radiation affecting pregnancy from the participants' point of view

types of medical radiation affecting pregnancy	Male		Female		Total		P-vale
	No.	%	No.	%	No.	%	
X-ray	165	26%	222	25%	387	26 %	0.889
CT	146	23%	194	22%	340	22 %	0.881
MRI	155	24%	235	27%	390	26 %	0.674
Ultrasound	91	14%	94	11%	185	12 %	0.549
Mammography	80	13%	132	15%	212	14 %	0.705

Figure (5): types of medical radiation affecting pregnancy according to participants' knowledge



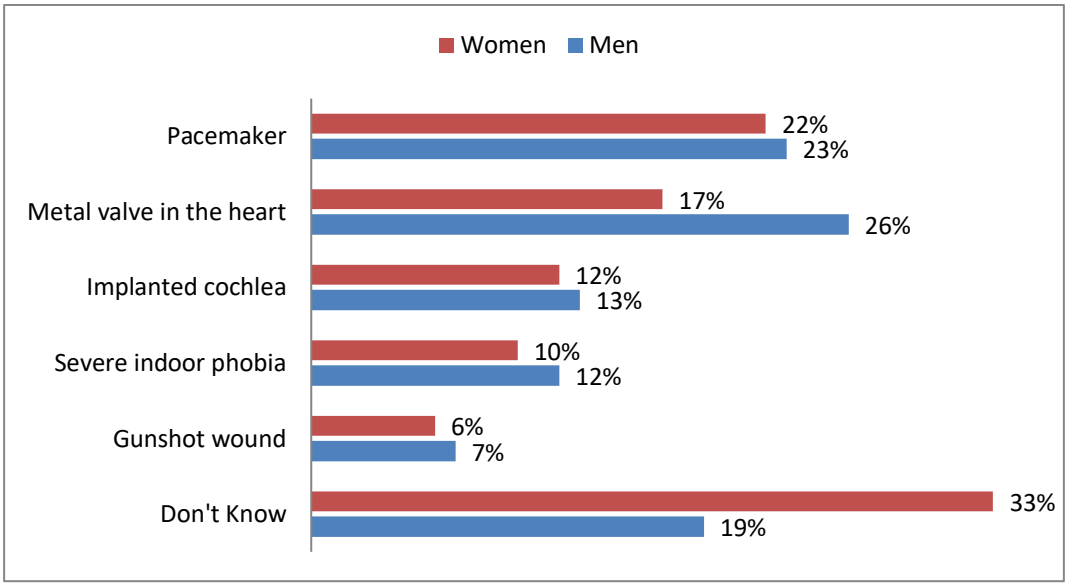
Knowledge of MRI contra indication

Table (8) and Figure (6) show distribution of participants regarding knowledge of contra indication to MRI. No significant differences were observed regarding contra indication of MRI and metal valve in the heart, pace maker, and implanted cochlea, as well as severe indoor phobia and, gunshot wound or did not know.

Table (8): Distribution of participants according to their knowledge of MRI contra indication

Contra indication to MRI	Men		Women		Total		P-vale
	No.	%	No.	%	No.	%	
Pacemaker	148	26%	133	20%	281	23%	0.881
Metal valve in the heart	133	23%	166	25%	299	24%	0.170
Implanted a cochlea	73	13%	89	13%	162	13%	0.841
Severe indoor phobia	68	12%	78	12%	146	12%	0.670
Gunshot wound	42	7%	47	7%	89	7%	0.782
Do not know	109	19%	148	22%	257	21%	0.052

Figure (6): participants' knowledge on the contraindication to MRI

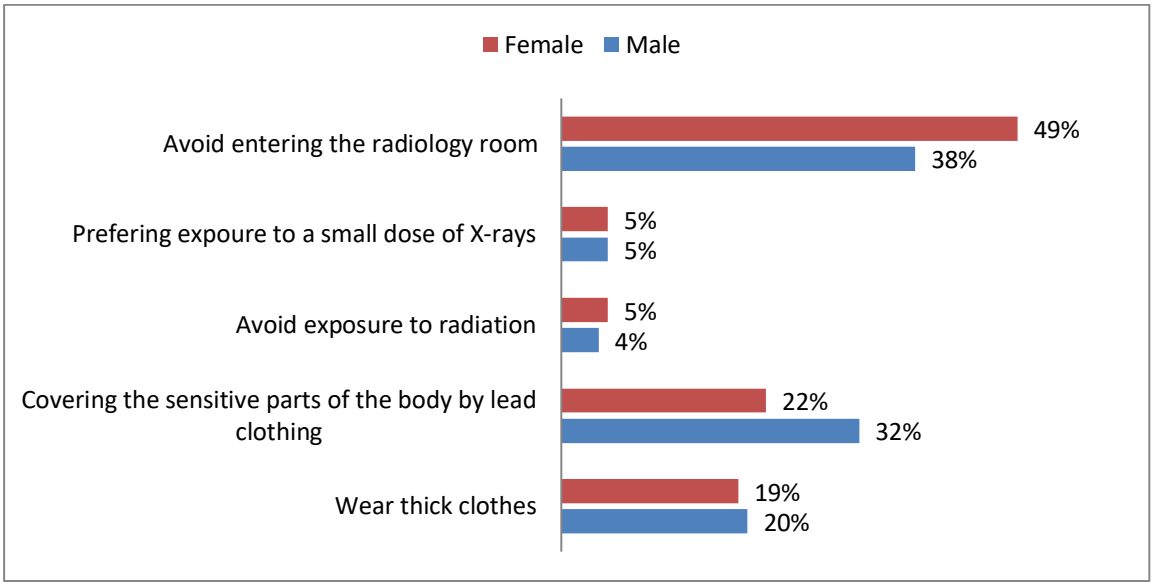


Considering ways for protection against medical radiation; no gender differences were observed regarding avoid entering the examination room (P =0.238), preferring a small dose of X-rays (P =1.000), and none exposure to any radiation (p = 0.738) as well as Covering the sensitive parts of the body by lead clothing (P = 0.174) and wearing thick clothes (P = 0.873). Table (9) and figure (7).

Table (9): knowledge of participants on ways of protection against medical radiation

ways of protection against medical radiation	Male		Female		Total		P-vale
	No.	%	No.	%	No.	%	
Avoid entering the examination room	128	38%	193	49%	321	44%	0.238
Preferring exposure to a small dose of X-rays	18	5%	21	5%	39	5%	1.000
None exposure to any radiation	14	4%	20	5%	34	5%	0.738
Covering the sensitive parts of the body by lead clothing	109	32%	85	22%	194	27%	0.174
Wearing thick clothes	67	20%	75	19%	142	19%	0.873

Figure (7): Knowledge of participants on ways of protection against medical radiation



1- Discussion:

The present study aimed to assess the awareness and knowledge of the public regarding medical radiation (diagnosis and treatment), its types, radiation hazards, fears, pregnancy and radiation and protection methods. Radiological examinations are now essential tools used daily to diagnose and treat different diseases. In addition, this study has limitations regarding generalization.
The population of the present study represents an educated group and young age 20-39years old (73.1%), and may not necessarily be representative of the target population.

previous use of medical radiation devices

We found that more than half of participants were lacking knowledge about uses of medical radiation. They believed that radiation is related to medical diagnosis only. This result go with Shakhreet's study which demonstrated insufficient concept of radiation as most of their participants were confined in their perception of radiation medical diagnosis. [3] This may be because people usually referred to radiologist for diagnosis of their problems. Also, around two thirds of the participants had experienced a previous examination by medical radiation devices.

Risk regardless device

Though there are differences between the radiations risk depending on the type of device, about one fifth of believed that the radiation has the same risks. A recent study conducted in the Middle East showed that 70% of participants thought that there are differences between radiations risk and its effect on humans.[3]

Radiation and pregnancy

The present study showed that a large proportion of participants believed that exposure to radiation is dangerous for pregnant women. The most important types of medical radiation that affect pregnancy were MRI, followed by X-rays then CT. Lastly, mammography and ultrasound. According to Yucel's study[8] safer modality of radiation for pregnant women were CT, Radiography, US, mammography and MRI. The misperception and lack of awareness where most of the population believed that MRI should be avoided during pregnancy as it emit ionizing radiation [8, 17,18,19] which may lead to increased anxiety when they should undergo MRI examination while they are pregnant.[8] Despite, there is no

indication that the use of clinical MRI procedures during pregnancy lead to adverse effects, the safety of such procedures has not been proven [20, 21] and currently there is a significant level of uncertainty regarding the risk of MRI using to pregnant patients [22,23]. So, we recommend focusing on raising pregnant women's awareness about radiation types and their risk to the fetus.

MRI Contraindications:

Lack of knowledge about MRI contraindications was observed among 13% of the participants who didn't think that MRI may prevent some patients from using it and 21% of lack knowledge about which cases are contraindicated. This lack of awareness is in agreement with Chesson's study[15], where they found that patients were not informed well about CT, MRI and, US.

Accordingly to prevent incidents and accidents associated with MRI; it is necessary to increase awareness of the public on MRI and provide them with necessary information. Radiologists are encouraged to provide such information. (8)

Significantly more men than women (0.014) agreed to work or any of their relatives in medical radiology department. This is because men in our country used to work than women. Likewise, Shakhreet study[3] showed that the majority of participants did not mind working in the field of radiology compared to the rest who preferred other important disciplines and afraid from radiation risk.

Radiation Protection

Most of medical radiation nowadays are used for diagnosis and treatment of many diseases, but should be under recommended dose measurements and guidance on safe radiology practice. Surprisingly, more than half of participants (60.7%) showed lack of awareness according to medical radiation protection and safety precautions. Recent study demonstrated that patients had insufficient knowledge according to that.[24] few studies are focusing on patients and general population awareness about radiation protection in the literature [14]. In Yucel's study which showed similar result, the most of respondents prefer "unnecessary entering radiological examination room" as a protection method. Then, covering the sensitive parts of the body by lead and wearing thick cloth [8]. Other studies conducted on health care workers especially non radiologist, interns and medical students. [14] Despite that, these studies indicated inadequate information regarding ionizing radiation and radiation protection among medical student, significantly greater in male students in comparison with female students, but also the result improved after a lecture about radiation protection. [25,26,27,7,16]. Also, studies which conducted to assess the awareness of physician with radiation risk and radiation dose of medical examination, show lack of awareness among physician and these results give us attention to conduct the same study among our physicians, interns and medical students. In addition, they recommended that

radiation protection should be mandatory and part of the medical school curriculum and conducting additional lectures to improve health services quality by minimizing patient exposure dose and providing proper patient education about that. They concluded that, knowledge on radiation hazards and protection is not adequate. There is no significant gender difference in knowledge and education is the most important factor for preventing unnecessary radiological examination among physicians and patients. **[28, 29, 30]**

Fears of radiation Usage:

People's concerns about exposure to radiation varied, but most of these were mutation and birth defects, the least were hair loss and decrease human immunity and bone pain with significantly difference between men and women regarding infertility (0.029) this may be explained by the fact that men feel that this affect their masculinity and also may affect family bonds if they have no kids. The same results were demonstrated in Shahreekt's study[3], fears from mutation came first among women and infertility among men. This might be related to ability of women to get pregnant. In contrast to Yucel's study[8] where people were more concerned about cancer and less about cataract and skin wounds. However, doctors from both genders were afraid from risk of cancers and that is true where the long-term danger of radiation elevating a person's lifetime risk of cancer especially in pediatrics. [9, 10, 11] On the other hand, this fear is unjustified, as there are many ways to protect ourselves from radiation and reduce the exposure to radiation.[3] Lack of knowledge about the recommended doses of exposure to radiation were found in many studies .[12, 13, 14]

Knowledge about different types of medical radiation modalities:

The result of the present study showed that MRI was the most known knowledge among both genders of the participants, where mammography was the least known technique especially among men. This is in agreement with Shakhreet's study[3] which indicated that non-medical personnel of both genders were lacking awareness regarding mammography as only 22% of men and 42% of women had knowledge about that technology. On the other hand, medical specialists (70%) have not enough knowledge of this type of diagnosis where they should be more familiar with it. They assessed also, awareness about angiography and fluoroscopy and found that radiologists were less familiar with those radiological modalities and only 7% of male and 4% of female radiologists knew them. **[3]** According to that, it is important to provide awareness, educational courses and campaign to teach all segments of the population this types of imaging technique especially mammography to reduce the spread of breast cancer. Chesson's study[15] found that over half of respondents didn't know the investigation they were to have. Women had more knowledge about ultrasound and this is explained by the fact that it is related to obstetric

management. [15] So, patient information is needed regarding radiological procedures especially in the light of rapid technological developments.

Radiation hazards

In the present study, more than two thirds had knowledge about medical radiation damage with no gender differences. The same was found by Tavakoli et al.[16] However, gender differences were observed by Salih et al[6]

Sources of knowledge

The most important sources of participants' information about hazards of medical radiations were health workers followed by social media this reveals the important role of health workers in public education. On the other hand, Chesson's study[15] demonstrated that the main source of information was families and friends.

Recommendations:

- Establish awareness campaigns about benefits, hazards and protection of different types of medical radiation in collaboration with the national radiology community to publish and deliver informative brochures.
- Increase public knowledge as government has responsibility to start education and give information about radiation starting from school till university.
- Encourage radiologists to organize meetings, conferences, even TV programs about this issue.

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8. Abbreviations:

- **MRI: Magnetic Resonance Imaging.**
- **CT: Computed Tomography.**
- **US: Ultrasound.**
- **KSA: Kingdom of Saudi Arabia.**