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RESEARCH ARTICLE

KNOWLEDGE AND ATTITUDE OF SAUDI WOMEN TOWARDS THE RISK OF EXPOSURE TO RADIATION DURING PREGNANCY

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ABSTRACT

Introduction: Women exposure to radiation during pregnancy can be really harmful to fetus. However a lot of women might not know this fact, especially the singles, new married ones who are about to become mothers.

Aim: To assess the knowledge and attitude of the Saudi women towards the risk of exposure to radiation during pregnancy.

Methods: Randomly distributed electronically made questionnaire during the summer of 2016 to Saudi females. All data were electronically collected within 2 month time of distribution and then analyzed using SPSS (The Statistical Package for Social Sciences) version 16.0 software.

Results: In total a 519 questionnaire was distributed across five regions of the kingdom of Saudi Arabia of which 510/519 (98.3%) responded. Around 82.2% of the women responded were between the age of 18-40 years and 69.4% of the women were married. 87.8% of women involved had previous knowledge about the health hazards of exposure to radiation during pregnancy. In the group of women who were aware of the risk, it was clear that occupation is the major factor that contributed in their awareness while being a governmental worker improves this awareness significantly (p-value>0.05). There were no significant differences in the knowledge between the regions although around 39% of the study population was from the west part of the country. In all 12.2 % (62/510) of the women did not know that exposure to radiation will put any risk on the fetus if they were exposed.

Conclusion: Although the majority of the women involved in the study had awareness of the risk of infection, small group were an aware of that risk. The study clearly indicates that there is a need of more awareness campaigns in the community to increase the knowledge and attitude towards exposure to radiology and decrease the associated risk and complications.

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INTRODUCTION

Pregnancy is considered as an important event of the women life's enthusiastic and exhilarating experiences. The main goal of each pregnancy is to keep the mother well to get healthy baby. Recently, there is an increasing utilization of the diagnostic procedures during pregnancy by many physicians (Patil *et al*., 2013). Radiology is a corner stone in modern medicine. Numerous diagnostic and interventional radiological procedures lead to exposure to ionizing radiation.

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Despite of the advantages of imaging outrank the related dangers of radiation, there is a growing concern over the drawbacks of ionizing radiation on patients health (Ramanathan and Ryan, 2015). The decision of implementation of radiological procedures to pregnant women for diagnostic or therapeutic issues is a confused situation. Clinicians who referred them for performing these procedures are understandably concerned about the possible hazards of radiation exposure to the developing fetus (Eskandar *et al*., 2010). In the United States, the risk related to prenatal exposure to ionizing radiation is generally low. The harmful effect of this exposure takes the form of birth defects, growth retardation, abortion and/or mental retardation (NCRP, 2013). This principle counteracts with medical concerns about the potential

risks to pregnant patients particularity when radiological maneuvers are seriously required. An appropriate benefit/risk perspective is essential to properly manage ill or injured pregnant patient (Prasad *et al*., 2016). Several researches have been conducted among physicians of different medical specialtiesas regarding the radiation risks incurred to patients during common imaging maneuvers (Keijzers and Britton, 2010; Brown and Jones, 2013; Günalp *et al*., 2016). On the contrary, there is no perviousstudy has been performed targeting women in child bearing period assessing their knowledge and attitude towards the risk of exposure to radiation during pregnancy in KSA. Thus, this study will determine Saudi females' knowledge and attitude towards the health hazards of exposure to radiation during pregnancy on their fetus, and to study the factors affecting their knowledge and attitude.

Subjects and Methods

Cross-sectional research was carried out during the summer of 2016, in all regions of KSA. A randomly distributed Arabic electronically made questionnaire was utilized to assess the knowledge and attitude of Saudi females about the exposure to radiation during pregnancy (see Figure 1). The questionnaire was questions mainly in multiple choice/true-or-false format, divided into three sections covering demographic data, radiation knowledge/awareness and practice if pregnant. This study included 510 women at the age of child bearing period. All data was electronically collected within 2 months of distribution. This delivering was approved by the Ethical Research Committee of the Faculty of Medicine, Al Baha University, KSA. Data were checked, coded, entered and analyzed using SPSS (The Statistical Package for Social Sciences) version 16.0 software. Significance tests: Chi-square (X^2) test and Fishers exact test were used to test for the differences between categorical data. The results were collected and analyzed using the 0.05 significance level.

RESULTS

Table 1. General characteristics of the study group

General characteristics	Study group (n=510)	
	No	%
Age groups		
< 18 y	11	2.2
18-30 y	281	55.1
31-40 y	138	27.1
> 40 y	80	15.7
Marital status		
Married	354	69.4
Not married	156	30.6
Occupation		
House wife	175	34.3
Student	156	30.6
Governmental workers	114	22.4
Private workers	31	6.1
Health care workers	34	6.7
Residence region		
Hijaz (west)	198	38.9
Najd (center)	109	21.3
South	104	20.4
East	91	17.8
North	8	1.6

In Table (1), 87.8% of involved women had previous knowledge about the health hazards of exposure to radiation during pregnancy,55.1% of them had known that exposure to radiation is hazardous during the whole pregnancy period, while 29% of them limit the harmful period of exposure to radiation to the first trimester only, and the rest (15.9%) had no ideas. Health care providers, readings, relatives and friends and internet represented about 90% of the source of this knowledge. Congenital anomalies, affection of brain function, delayed neonatal development, neonatal cancer and abortion were the main complication of exposure to radiation during pregnancy known by the study group, but 54 of them (10.6%) had no ideas (Figure 1).

Table 2. Knowledge about the health hazards of exposure to radiation during pregnancy of the study group

Knowledge	Study group (n=510)	
	No	%
Previous		
Yes	488	87.8
No	62	12.2
Source		
Health care providers	182	35.7
Reading	116	22.7
Relatives and friends	86	16.9
Internet	66	12.9
TV	19	3.7
Non	41	8
Hazards and pregnancy		
First trimester	148	29
All period	281	55.1
I don't Know	81	15.9

Around 55% of the people involved were between the age of 18 -30 years old, and more than 69% were married. Around 34.4 were house wives and more than 38% of the studied population was from the western rejoin of the Saudi Arabia.

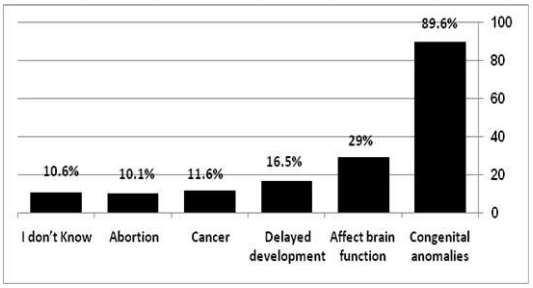

Figure 1. Distribution of knowledge about possible neonatal hazards related to exposure to radiation during pregnancy among the study group

Table 3. Factors affecting the previous knowledge about the health hazards of exposure to radiation during pregnancy of the study group

Factors	Previous knowledge		p-value
	Present (n=448)	Absent (n=62)	
	No (%)	No (%)	
Age groups			
< 18 y	7 (1.6%)	4 (6.5%)	0.012*
18-30 y	243 (54.2%)	38 (61.4%)	0.28
31-40 y	124 (27.7%)	14 (22.4%)	0.38
> 40 y	74 (16.5%)	6 (9.7%)	0.17
Marital status			
Married	311 (69.4%)	43 (69%)	0.95
Not married	137 (30.6%)	19 (31%)	
Occupation			
House wife	144 (32.1%)	31(50%)	0.005*
Student	139 (31%)	17 (27.4%)	0.56
Governmental workers	109 (24.4%)	5 (8%)	0.004*
Private workers	23 (5.1%)	8 (13%)	0.014*
Health care workers	33 (7.4%)	1 (1.6%)	0.087
Residence region			
Hijaz (west)	177 (39.5%)	21(33.9%)	0.39
Najd (center)	93 (20.8%)	16 (25.9%)	0.36
South	90 (20.1%)	14 (22.4%)	0.67
East	80 (17.9%)	11 (17.8%)	0.98
North	8 (1.7%)	0 (0%)	0.3

Table 4. Attitude of previously pregnant women to exposure to radiation during pregnancy

Attitude	Previously pregnant group (n=361)	
	No	%
Tell doctor or technician		
Yes	345	95.6
No	16	4.4
Refuse to expose to radiation except in emergency during pregnancy		
Yes	326	90.3
No	35	9.7
Exposed to radiation		
Yes	59	16.3
No	302	83.7

Table 5. Factors affecting the attitude about telling the doctor or technician about the exposure to radiation during pregnancy

Factors	Tell doctor or technician		p-value
	Present (n=345)	Absent (n=16)	
	No (%)	No (%)	
Age groups			
< 18 y	2 (0.6%)	0 (0%)	0.76
18-30 y	139 (40.3%)	13 (81.25%)	0.002*
31-40 y	127 (36.8%)	2 (12.5%)	0.048*
> 40 y	77 (22.3%)	1 (6.25%)	0.31
Marital status			
Married	336 (97.4%)	16 (100%)	0.51
Not married	9 (2.6%)	0 (0%)	
Occupation			
House wife	161 (46.7%)	7 (43.75%)	0.82
Student	36 (10.4%)	6 (37.5%)	0.001*
Governmental workers	100 (29%)	1 (6.25%)	0.048*
Private workers	26 (7.5%)	1 (6.25%)	0.85
Health care workers	22 (6.4%)	1 (6.25%)	0.98
Residence region			
Hijaz (west)	137 (39.7%)	2 (12.5%)	0.03*
Najd (center)	74 (21.5%)	5 (31.25%)	0.36
South	76 (22%)	3 (18.75%)	0.76
East	52 (15.1%)	6 (37.5%)	0.017*
North	6 (1.7%)	0 (0%)	0.6

Table 6. Factors affecting the attitude about refuse to expose to radiation except in emergency during pregnancy

Factors	Refuse to expose to radiation except in emergency during pregnancy		p-value
	Present (n=326)	Absent (n=35)	
	No (%)	No (%)	
Age groups			
18-30 y	132 (40.5%)	22 (62.9%)	0.011*
31-40 y	121 (37.1%)	7 (20%)	0.045*
> 40 y	73 (22.4%)	6 (17.1%)	0.47
Marital status			
Married	320 (98.2%)	32 (91.4%)	0.014*
Not married	6 (1.8%)	3 (8.6%)	
Occupation			
House wife	146 (44.8%)	21 (60%)	0.087
Student	35 (10.7%)	8 (22.9%)	0.034*
Governmental workers	94 (28.8%)	5 (14.3%)	0.07
Private workers	27 (8.3%)	1 (2.8%)	0.25
Health care workers	24 (7.4%)	0 (0%)	0.1
Residence region			
Hijaz (west)	130 (39.9%)	12 (34.3%)	0.52
Najd (center)	73 (22.4%)	5 (14.3%)	0.27
South	68 (20.9%)	11 (31.4%)	0.15
East	50 (15.3%)	6 (17.2%)	0.77
North	5 (1.5%)	1 (2.8%)	0.56

Table (3) shows that the age and the occupation were the main factors affecting the females awareness about radiation exposure risk and pregnancy in KSA (p-value <0.05), and insignificant as regards marital status and regional residence (p-value >0.05). Being <18 years, house wife and private worker restrict this awareness while being governmental worker improve this awareness significantly (p-value <0.05).

The attitude of previously 361 pregnant women to exposure to radiation during pregnancy was 95.6% told doctor or technician about their pregnancy, 90.3% refuse to expose to radiation except in emergency during pregnancy, but 16.3% had exposed to radiation during pregnancy (Table 4). Table (5) shows that the age and the occupation were the main factors affecting the females attitude about telling doctor or technician about their

Table 7. Factors affecting the attitude about the exposure to radiation during pregnancy

Factors	Exposed to radiation		p-value
	Present (n=59)	Absent (n=302)	
	No (%)	No (%)	
Age groups			
18-30 y	24 (40.7%)	128 (42.4%)	0.81
31-40 y	18 (30.5%)	112 (37.1%)	0.33
> 40 y	17 (28.8%)	62 (20.5%)	0.16
Marital status			
Married	59 (100%)	294 (97.4%)	0.21
Not married	0 (0%)	8 (2.6%)	
Occupation			
House wife	29 (49.2%)	139 (46%)	0.65
Student	7 (11.8%)	36 (11.9%)	0.98
Governmental workers	15 (25.4%)	85 (28.1%)	0.67
Private workers	5 (8.5%)	23 (7.6%)	0.81
Health care workers	3 (5.1%)	19 (6.4%)	0.71
Residence region			
Hijaz (west)	29 (49.2%)	109 (38.2%)	0.12
Najd (center)	15 (25.4%)	65 (21.5%)	0.6
South	11 (8.6%)	69 (22.8%)	0.014*
East	4 (6.8%)	53 (17.5%)	0.04*
North	0 (0%)	6 (2%)	0.27

pregnancy in KSA (p-value <0.05), and insignificant as regards marital status and regional residence (p-value >0.05). Being 18-30 years, students and lived in the east region decrease this attitude while being aged 31-40 years, governmental worker and residence at Hijaz increase this attitude significantly (p-value <0.05). Table (6) demonstrates that age, marital status and occupation were significantly affecting the attitude of refusing the exposure to radiation except in emergency states during pregnancy (p-value <0.05). This attitude is enhanced by age range between 31-40 years, married and students and reduced by being 18-30 years significantly (p-value <0.05).In Table (7), there is no significant factors affecting the attitude about accepting the exposure to radiation during pregnancy(p-value >0.05). Residents in the east or south region were significantly exposed to radiation during their pregnancy (p-value <0.05).

DISCUSSION

Radiation exposure to pregnant patients either from diagnostic or therapeutic reasons has been an important issue. This study revealed that majority of included females (87.8%) had previous knowledge about the risk of exposure to radiation during pregnancy originated from health care providers, readings, relatives and friends and internet. This observation of high level of awareness among the studied females about the risk of exposure to radiation on fetus is supported by data which was reported by Vadachia *et al*. (2008), who found that 56.8% of involved women were known that prenatal exposure to ionizing radiation was harmful to the fetus. On contrary, many researchers, who reported that pregnant or potentially pregnant women when attending physicians and radiologists showed poor levels of awareness about the risks of exposure to radiation to the fetus associated with marked deficit in the knowledge level of clinicians at different medical fields (Shaw *et al*., 2011; Lee *et al*., 2012; Sin *et al*., 2013). This contradiction can be explained as this study was designed to deal Saudi females through a randomly distributed electronically made questionnaire. From the point, highly educated and active women from different regions in KSA were participated in this research randomly and freely by high response rate 98.3%. Additionally, health care workers play a great role in the improvement of the awareness of the studied females about the hazards of radiation exposure during pregnancy by 35.7% of them due to the effective application of patient safety measures in KSA (Alahmadi, 2010; El-Jardali *et al*., 2014), and then followed by readings, relatives and friends and internet. Moreover, the systemic review of some studies may reflect the ignorance of the radiation dose and/or the safety practice was considered as a major element of low level of awareness among patients and hospital workers (CADTH, 2015; Awosan *et al*., 2016). Pregnancy reflects a great challenge in regard to radiation exposure. Thereafter, the decisions to expose the pregnant women must include the need to balance the benefit of the imaging study to the pregnant with the possible hazard from the radiation exposure to the fetus (Bural *et al*., 2012). The fetus is highly susceptible to ionizing radiation hazardous effects at age ranged between 8 to 15 weeks of pregnancy (Williams and Fletcher, 2010; Yang *et al*., 2017). Data of the present study showed that more than half of Saudi females (55%) had known that exposure to radiation is harmful during the whole period of pregnancy, while 29% of them limit the hazardous period of exposure to radiation to the first trimester only, but 15.9% of them were uncertain of any possible hazards.

This finding was disagreed with data reported by Vadachia and his colleagues, (2008), who found that 54 out of 125 participated women (43.2%) selected that prenatal exposure to radiation was harmless and 51 women (40.8%) thought the first trimester as the most radiosensitive period of gestation, while twenty of them note that radiation is harmful during the pregnancy period. The hazardous impact of prenatal exposure to radiation can be teratogenic, carcinogenic, or mutagenic and are covariant associated with the level of radiation exposure (the dose, time of exposure and type of radiation), the area of the women body exposed to radiation namely (the abdomen and the pelvis), and finally the gestational age (Shaw *et al*., 2011; Choi *et al.*, 2013). This study revealed the view of the Saudi females about the possible hazardous effects on fetus if exposed to radiation were congenital anomalies (89.6%), affection of brain function (29%), delayed neonatal development (16.3%), neonatal cancer (11.6%) and abortion (10.1%), but 54 of them (10.6%) had no ideas. These findings were in approximate to Vadachia *et al*. (2008) who reported that 56.8% of involved women reported that prenatal exposure to ionizing radiation may cause severe effects (congenital anomalies) or abortion. Additionally, intra uterine growth retardation, mental retardation, reduced head/brain circumference, neocortical ectopias, callosal regression and

brain cancer are the can create more frequent fetal disfigurement after compelling radiation exposure during the early fetal period (Williams and Fletcher, 2010; Yang *et al*., 2017). Moreover, in utero irradiation increased the risk of cancer especially childhood leukaemia even with extremely low frequency magnetic fields (ELF-MF) (Teepen and van Dijck, 2012). This study surveyed Saudi females' knowledge about radiological management during pregnancy, which was significantly affected by the age and occupation (p-value were 0.034 and <0.001 respectively). Better significant knowledge of hazards related to ionizing radiation exposure was among governmental workers. On the other hand, younger females aged below 18 years, house wife and private workers hinder this knowledge. Similarly, Dehghani *et al*. (2014) reported that the age and job type of patients attending radiology departments were the factors affecting the patient's radiation-safety score significantly (p-value were 0.017and <0.001 respectively).

As regarding the attitude of previously 361pregnant women in relation to performing radiological maneuver was excellent exceeding 90% in the form of telling the doctor or technician about their pregnancy and they refuse to expose to radiation except in emergency during pregnancy and 16.3% actually had exposed to radiation during their pregnancy either in emergency conditions or before establishment of diagnosis of pregnancy. Furthermore, diagnosis of pregnancy on clinical practice may be difficult in women had irregular cycles or using contraceptives facilitating the exposure to radiation particularly in the early stage of pregnancy (Vadachia *et al*., 2008). The safety of diagnostic and/or therapeutic procedures in relation to pregnancy creates a great interest for all clinicians. They should be aware about the bases and guidelines of different radiological maneuvers at various periods of pregnancy, to choose the suitable procedure (Prasad *et al*., 2016; Mazeron *et al*., 2016). Telling doctor or technician about their pregnancy in this study was significantly related to the age and the occupation of the involved study group especially among females aged 31-40 years, governmental worker and residence at Hijaz. These observations were reported by many researchers in KSA such as (Alahmadi, 2010; El-Jardali *et al*., 2014). In the present study, age, marital status and occupation were significantly affecting the attitude of refusing the exposure to radiation except in emergency states during pregnancy (p-value <0.05). This attitude is enhanced by age range between 31-40 years, married and students and reduced by being 18-30 years significantly (p-value <0.05). This finding can be explained as there is no significant factors affecting the attitude about accepting the exposure to radiation during pregnancy among the studied Saudi females (p-value >0.05). Residents in the east or south region were significantly exposed to radiation during their pregnancy (p-value <0.05). This can explained as in emergency conditions or when radiological examination is seriously required, the clinician only have the decision for doing these maneuvers as regarding the pregnant women benefit (Wang *et al*., 2012; Tirada *et al*., 2015).

Conclusion and recommendation

The present study can conclude high level of awareness and attitude among Saudi females as regarding the risk of prenatal exposure to radiation. But, there is still small group was unaware about this risk. Thus, this study was conducted for the enhancement of public awareness of the potential hazard of radiation; particularly as regarding pregnant women; has required the involvement of several organizations and the establishment of radiological protection standards, legislation, guidelines and programs. Pregnant females should be counseled before any radiological procedure as regarding risks and benefits. Moreover, improvement is needed to increase the awareness of future Saudi pregnant or potentially pregnant women toward the possible risk of exposure to radiation through continuous training of health care providers generally and radiology departments in special concern.

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Study Questionnaire

1. I agree to participate in this study

o Yes.
o No.

2. Age:

o Less than 18 years old.
o 18 – 30 years old.
o 30 – 40 years old.
o More than 40 years old.

3. Marital status:

o Married.
o Not married.

4. Work:

o Housewife .
o Student .
o Government employee.
o Private sector employee.
o Health-care sector employee.

5. I had a previous knowledge about radiation exposure risks during pregnancy:

o Yes.
o No.

6. How you know about radiation risks on pregnant women (If the answer to the previous question is yes) ?

o TV.
o Reading.
o Friends, Coworkers, relatives.
o Internet & social media.
o Doctors or health-care workers in hospitals & primary health care centers.
o **7**

Have you been exposed to radiological tests during pregnancy?

o Yes
o No
o Not applicable (un married)

8. During radiological tests I inform the doctor or the technician if I am pregnant:

o Yes
o No
o Not applicable (un married)

9. I'm refusing any radiological tests during pregnancy except in emergency situation:

o Yes
o No
o Not applicable (un married)

10. I think the exposure to radiation during pregnancy may cause:

o Fetal malformations (birth defect)

o Cancers
o Abortions (miscarriage)
o Growth retardation
o Effects on the functions of fetus's brain
o I don't Know

11. I think that the risks of radiation during pregnancy:

o Only during first three months of pregnancy
o Remain constant throughout pregnancy
o I don't know

12. City:

o Riyadh
o Makkah
o Eastern Region
o Madina El Monawara
o Qassim
o Ha'il
o Northern borders.
o Al-Jawf.
o Tabuk.
o Baha.
o Asir.
o Jazan.
o Najran.

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