Original Research Article

Evaluation of The Knowledge of Saudi Women in Childbearing Period Towards Toxoplasmosis Induced Teratogenicity – Evidence from A Cross-Sectional Study

Abstract

Background: Toxoplasmosis is an environmental teratogen that may disrupt fetal development if transferred to the mother during pregnancy, resulting in maldevelopment and newborn mortality.

Objective: To assess knowledge of Saudi women in their childbearing period as regards risk factors of Toxoplasmosis infestation, testing, awareness of disease manifestation and prevention.

Methods: Anonymous online survey was used to examine the knowledge of Saudi women in their childbearing period about Toxoplasmosis induced teratogenicity. The non-probability sampling yields a calculated size of 600 women. The cross-sectional design of the research required categorizing the questions into two significant portions, one for sociodemographic data and the other for assessing Toxoplasmosis awareness. First, a descriptive statistic summarized the demographic characteristics. In categorical data, chi-square tests were employed to compare groups.

Results: A total of 613 women in their childbearing years completed the questionnaire. Most respondents interviewed were 36-40 (46.7%), and Para 1-5 (80%), and 86% were graduates. In addition, 42.2 % had the basic knowledge of Toxoplasmosis, 25.3 % were aware of the manifestations of the disease, and 76.3% correctly identified premature labor or miscarriage as sequelae of the infection. Aside from the frequency of abnormalities and parities and knowledge of toxoplasmosis, no other demographics in our research sample showed a significant association.

Conclusion: The basic knowledge of Toxoplasmosis among Saudi women of childbearing age is unsatisfactory (42.6 %). Age, family income, educational level and the number of abortions were significantly associated with knowledge of Toxoplasmosis among Saudi women in their childbearing age.

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Keywords: Knowledge, Childbearing period, Toxoplasmosis, Teratogen, Saudi

1. Introduction

Teratogens are environmental agents that can disrupt fetal development if mothers exposed to teratogens during pregnancy, leading to maldevelopment and death of the infant. It was thought that congenital anomalies were only genetic until Murphy discovered that environmental factors contributed to congenital anomalies (1). Recent research indicates that nearly 15% of all congenital malformations are related to environmental teratogens (2). When the genetic and environmental factors are considered, it is estimated that 15% of all congenital anomalies occur as a result of environmental causes, which include metabolic conditions, physical, chemical, and infectious exposures (3). Because most of these risks are modifiable, increasing awareness about teratogenic risks can help reduce congenital defects (4).

Toxoplasma gondii (*T. gondii*) is a parasitic single-celled organism that may infect nearly all animals and birds. Wild and domestic cats are the parasite's ultimate hosts because it only reproduces in cats. In the United States, *T. gondii* is the third most common cause of deadly food-borne illness (5). Toxoplasma infection affects around 11% of people in the United States who are six years old or older. More than 60% of specific populations have been proven to be infected with Toxoplasma in different regions across the globe (6). A study done in Jazan, Saudi Arabia that aimed to explore the prevalence of Toxoplasma, found that the overall seroprevalence of T. gondii was 24.1% among pregnant woman. The prevalence of toxoplasmosis increases with increase in age (7). Another study found that the prevalence of Toxoplasma gondii IgG and IgM antibodies was 32.5% and 6.4%, respectively (8). Preventive strategies are mostly dependent on women's understanding of toxoplasmosis, its transmission, and etiology. Previous research has revealed varying degrees of knowledge among pregnant women on the danger and consequences of toxoplasmosis infection during pregnancy (9-11).

In Saudi Arabia, most of the studies on toxoplasmosis in pregnancy made effort to determine the incidence of the disease or infection and the associated risk factors.

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Knowledge and prevention of toxoplasmosis during pregnancy can contribute to the start of primary prevention activities, which are essential to build public policies (12). Toxoplasmosis knowledge and prevention during pregnancy can aid in the beginning of primary preventive actions, which are necessary for the development of public policies (13).

Considering this, some studies have reported that toxoplasmosis-related knowledge, found that pregnant women are uninformed of how the infection is transmitted and do not take precautions (13-15). In Saudi Arabia, there is inadequate knowledge of risk factors including role of cats in disease transmission, eating undercooked foods, eating unwashed fruits and vegetables, and coming in contact with soil (14). This study aimed to evaluate the knowledge of Saudi women in their childbearing period about the risk behavior and knowledge related to toxoplasmosis.

2. Methods

A cross-sectional study was conducted using an anonymous online survey to examine the knowledge of Saudi pregnant women about toxoplasmosis induced teratogenicity. The sample size for this research was approximated using the non-probability sampling technique to about 600. The survey questions included were divided into two major sections. The first concerns women's demographics (age, income, educational level, parity, number of abortions and anomalies ……etc) . In contrast, the second section concerns risk behavior and knowledge related to toxoplasmosis among Saudi women in their childbearing period. The authors gathered data from the survey for three months, from July to September 2021. The King Saud University College of Medicine provided the required ethical clearance for the research (approval number E-16-1903).

Statistical Analysis: SPSS software (version 26) was used for statistical analysis. The demographic factors were summarized using descriptive statistics. For categorical data, chi-square tests were used to examine the differences across groups. A p-value of 0.05 was considered statistically significant.

3. Results

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A total of 613 women in their childbearing years completed the questionnaire. Most respondents interviewed were aged 36-40 (46.7%), and para 1-5 (80.1%), and only 1 % of women had more than 10 pregnancies. In terms of the income level of the women's families, 74.6 % reported that their income merely covers their family's requirements, while 13.9 % stated that their income surpasses their needs.

Of the women surveyed, only 0.8% did not know how to read or write; 1% went to elementary school; 12.2% went to secondary school, and 86% went to college or higher. Seventy-eight % of women had no prior history of abortion, whereas 22 % reported a previous history of abortion. Table 1 summarizes the sociodemographic characteristics of the interviewees.

261 (42.2 %) of the 613 Saudi women at their childbearing period involved in the study were aware of the presence of toxoplasmosis. Unfortunately, about three quarters of the study population (74.7 %) incorrectly identified the manifestations of toxoplasmosis. The following sources were identified as the most often used sources of information regarding toxoplasmosis: health care providers (67.9 %), the Internet and media (15.8 %), books (5.9 %), and relatives or friends (5.5 %). Figure 1

When asked how T. gondii was transmitted, 76.3 % of women said it was via a domestic cat, and 12.1 % said it was by eating the raw or undercooked meat. Only 5.4 % cent of surveyed women believed that insect bites transmit toxoplasmosis, and 11.6 % were unaware of the fact. About 20 %, 122 of participants, tested for toxoplasmosis; only 22 yielded positive results.

Preventive measures against toxoplasmosis included avoiding contact with cats (95.3%), personal cleanliness (93.8%), raw meat-eating (8.3%), and contact with previously infected individuals (5.9 %). 95 % of the participants thought that toxoplasmosis might be hazardous during pregnancy, and 76.3 % felt that infection with the parasite could induce preterm labor or miscarriage. Table 2 shows more details about knowledge of Saudi women in their childbearing period on *Toxoplasmosis*.

The authors applied chi-square test to detect potential associations between high knowledge of *T. gondii* and socio-demographic variables as shown in table 3. Except for

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the number of anomalies and parities, and awareness of toxoplasmosis, there was a significant association between other demographics in our study population. On the other hand, only educational level and the number of abortions showed a significant association with awareness of manifestations of toxoplasmosis. Finally, age and income level showed a high significant association ($P<0.001$) with the knowledgeability of women toward the ability of toxoplasmosis to cause premature labor or miscarriage.

4. Discussion

The present study's main thought is that Saudi women in their childbearing period had a meagre (42.2 %) fundamental awareness of toxoplasmosis. This finding is consistent with earlier data demonstrating that 48% of American women throughout the USA were aware of toxoplasmosis (16). According to another American study, fewer than half of pregnant women in the United States had heard of toxoplasmosis, and higher education levels were significantly associated with awareness of the disease (17). Similarly, Elsafi and his colleagues reported that 75% of 400 pregnant Saudi women had never heard of toxoplasmosis, and those who didn't know about it were 4.04 times more likely to get it (11). Only 4.4% of pregnant Sri Lankan women knew the *T. gondii* risk (18). These outcomes contrast with previous findings indicating pregnant women in Geneva, Switzerland had a high (87 %) awareness of toxoplasmosis (19), Polish pregnant women (94.4%) (20) and 75.3% of Dutch women had been exposed to toxoplasmosis information (21).

Surprisingly, only 27.8 % of the pregnant women surveyed in Niterói, Rio de Janeiro, reported being aware of toxoplasmosis. Those aware of T. gondii had a much-decreased chance of becoming T. gondii IgG seropositive (22). T. gondii infection is a significant concern for pregnant women in the three countries studied (Malaysia, the Philippines, and Thailand). However, only 11% of them were aware of toxoplasmosis-related information, and only 3.5% knew they had been tested for the disease (23). This result of the East Asian study is consistent with our results, where only 19.9% of Saudi women aware of toxoplasmosis reported T. gondii seropositivity.

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In terms of toxoplasmosis prevention, our study results were comparable to those obtained by Smereks *et al*. in terms of cats' or previously infected people's avoidance of contact with and raw meat consumption, personal hygiene, and impending premature labor and miscarriage caused by toxoplasmosis (20). Meanwhile, the Yemeni study explored that 39 % of pregnant Yemeni women agreed that cats' hair touch might be a source of infection and work in the garden without gloves (40.1%) (24).

In general, toxoplasmosis knowledgeability among Saudi women in their childbearing period was unsatisfactory. However, most knowledgeable women were aware of the infection's relationship with undercooked meat and recognized cats as a possible source of infection. Socio-demographics, including age, family income, educational level and the number of abortions, were significantly associated with toxoplasmosis knowledgeability. In contrast, only educational level and the number of abortions were significantly associated with toxoplasmosis manifestations awareness, and finally, age and family income were the only variables that showed significant association with the seriousness of the infection on pregnancy.

5. Conclusion

The fundamental understanding of Toxoplasmosis among Saudi women of childbearing age is unsatisfactory (42.6 %). Saudi women of childbearing age were shown to be much more knowledgeable about Toxoplasmosis when they were younger and had a higher income, higher educational level, and had more abortions. Only education level and the number of abortions were significantly associated with toxoplasmosis manifestations awareness.

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Table 1: Sociodemographic variables of the Saudi women in their childbearing period

Variables	N(%)
Age groups	
16-20	16(2.6)
21-25	25(4.1)
26-30	107(17.5)
31-35	179(29.2)
36-40	286(46.7)
Monthly Income	
Meets family needs	457(74.6)
Less than family needs	71(11.6)

Exceeds family needs	85(13.9)
Education level	
Illiterate	5(0.8)
Primary school	6(1.0)
Secondary school	75(12.2)
University	527(86.0)
Number of Parities	
1-5	491(80.1)
6-10	116(18.9)
11-15	6(1.0)
Number of abortions	
Non	479(78.1)
1-3	124(20.2)
4-7	10(1.6)
Number of anomalies	
Non	563(91.8)
One episode	45(7.3)
Two episodes	5(0.8)

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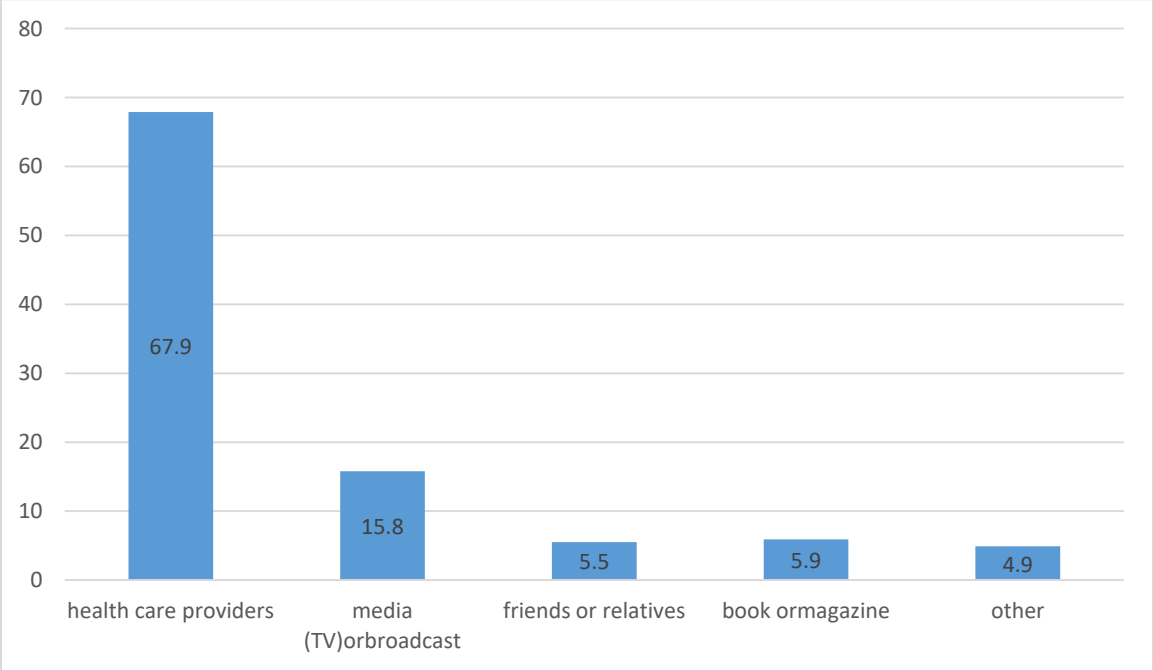

Figure 1: Source of knowledge on toxoplasmosis.

Table 2: Knowledge of Saudi women in their childbearing age on toxoplasmosis

Questions	N	%
Have you heard of toxoplasmosis?		
Yes	261	42.6
No	352	57.4
Understand the symptoms of toxoplasmosis.		
Yes	155	25.3
No	458	74.7
Do you think that toxoplasmosis can cause premature labor or miscarriage?		
Yes	468	76.3
No	145	23.7
Toxoplasmosis can spread by eating raw or undercooked meat		
Yes	74	12.1
No	230	37.5
I Don't know	309	50.4
Have you been tested for toxoplasmosis?		
Yes	122	19.9
No	491	80.1
The results of test		
Positive	22	3.6
Negative	100	16.3
Personal cleanliness (including washing of fresh fruits and vegetables before eating as well as after dealing with cats)		
Always	575	93.8
Sometimes	323	5.2
Never	6	1.0
Contact with previously infected individuals		
Yes	36	5.9
No	577	94.1
Insect bites can transmit toxoplasmosis		
Yes	33	5.4
No	509	83.0
Don't know	71	11.6
Toxoplasmosis might be hazardous during pregnancy		
Yes	584	95.3
No	29	4.7
Eat raw meet		
Yes	51	8.3
No	562	91.7
Source of knowledge		
Health care providers	416	67.9
Friends or relatives	34	5.5
Social Media (television) or broadcast	97	15.8
Book or magazine	36	5.9
Another resources	30	4.9

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Table 3: Association of basic knowledge of Saudi women in childbearing period regards their sociodemographic characteristics

	Do you know what toxoplasmosis is?		**P**	**Are you aware of symptoms of Toxoplasmosis?**		**P**	**Do you agree toxoplasmosis might result in premature labor or miscarriage?**		P
	Yes	No		Yes	No		Yes	No	
Total									
Age Category									
16-20	6 (37.5)	10 (62.5)	0.005*	3 (18.8)	13 (81.2)	0.161	7 (43.8)	9 (56.2)	<0.001*
21-25	9 (36)	16 (64)		9 (36)	16 (64)		17 (68)	8 (32)	
26-30	29 (27.1)	78 (72.9)		18 (16.8)	89 (83.2)		62 (57.9)	45 (42.1)	
31-35	88 (49.2)	91 (50.8)		48 (26.8)	131 (73.2)		149 (83.2)	30 (16.8)	
36-40	129 (45.1)	157 (54.9)		77 (26.9)	209 (73.1)		233 (81.5)	53 (18.5)	
Income									
Meets family needs	192 (42)	265 (58)	<0.001*	114 (24.9)	343 (75.1)	0.106	373 (81.6)	84 (18.6)	<0.001*
Less than family needs	19 (26.8)	52 (73.2)		13 (18.3)	58 (81.7)		44 (62)	27 (38)	
Exceeds family needs	50 (58.8)	35 (41.2)		28 (32.9)	57 (67.1)		51 (60)	34 (40)	
Education level									
Illiterate	2 (40)	3 (60)	0.001*	0	5 (100)	0.008*	5 (100)	0	0.165
Primary school	3 (50)	3 (50)		2 (33.3)	4 (66.7)		4 (66.7)	2 (33,3)	
Secondary school	16 (21.3)	59 (78.7)		8 (10.7)	67 (89.3)		51 (68)	24 (32)	
University	240 (45.5)	287 (54.5)		145 (27.5)	382 (72.5)		408 (77.4)	119 (22.6)	
Number of Parity									
1-5	215 (43.8)	267 (56.2)	0.162	125 (25.5)	366 (74.5)	0.334	370 (75.4)	121 (24.6)	0.504
6-10	42 (36.2)	74 (63.8)		27 (23.3)	89 (76.7)		93 (80.2)	23 (19.8)	
11-15	4 (66.7)	2 (33.3)		3 (50)	3 (50)		5 (83.3)	1 (16.7)	
Number of abortions									
Non	191 (39.9)	288 (60.1)	<0.001*	103 (21.5)	376 (78.5)	<0.001*	372 (77.7)	107 (22.3)	0.284
1-3	60 (48.4)	64 (51.6)		46 (37.1)	78 (62.9)		88 (71)	36 (29)	
4-7	10 (100)	0		6 (60)	4(40)		8 (80)	2 (20)	
Number of anomalies									
Non	244	322	0.072	143	423		434 (76.7)	132 (23.3)	

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	(43.1)	(56.9)		(25.3)	(74.7)				0.244
One episode	13 (31)	29 (69)		10 (23.8)	32 (76.2)	0.733	29 (69)	13 (31)	
Two episodes	4 (80)	1 (20)		2 (40)	3 (60)		5 (100)	0	

*Chi-square test

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