

An Observational Study to Assess the Level of Awareness and Perception of Toxoplasmosis among women of Childbearing age in Gaza City, Palestine

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ABSTRACT

Background: Toxoplasmosis is one of the world's most ubiquitous parasitic infections. According to numerous published studies and data, this disease affects approximately one-third of the world's population. In addition, it is caused by the obligatory intracellular parasite, *Toxoplasma gondii*.

Aim: To assess the level of toxoplasmosis awareness and knowledge among women of childbearing age in Gaza City, Palestine, as well as determine potential risk factors for toxoplasmosis. It is worth emphasizing that the researched region, Gaza City, is one of the world's most densely populated cities.

Method: The study's assessment approach involved the distribution of 400 questionnaires to women of childbearing age. Aside from gender and age, no other criteria were considered for assessment purposes.

Results: The findings of this questionnaire revealed that 38.25% of respondents had heard of this disease, 47.00% were knowledgeable about the means of transmission, and 35.00% were aware of the measures for managing and preventing toxoplasmosis. The most shocking finding was that merely 21.50% of respondents received counseling or information about this ailment, either through educational stages or from their treating physician. Additionally, the findings revealed that consuming raw meat, rearing domestic cats, direct contact with stray cats, and soil are all-important potential risk factors for acquiring this disease.

Conclusion: As a result, the study attempted to shed light on the inadequacy of toxoplasmosis knowledge and awareness, particularly among women of childbearing age in the study region. Considering this, the study recommends additional efforts to raise and develop a strong standard for toxoplasmosis knowledge and awareness among women of childbearing age in the study area.

Key words: Toxoplasmosis – childbearing age – awareness – risk factors – Gaza, Palestine.

INTRODUCTION

Given the numerous studies and statistical data indicating that toxoplasmosis infects more than one-third of the world's population, experts in this field have deemed toxoplasmosis to be one of the most common parasitic infections²⁴. Despite this, several studies have revealed that the prevalence of *T. gondii*, the parasite that causes toxoplasmosis, varies by territory, ranging from less than 10% to more than 90% in some regions³³. This extreme discrepancy in seroprevalence rates can be linked to a variety of factors and manifestations, including the age, culture, animal husbandry practices, and socioeconomic status of the target groups. Regional differences and different dietary patterns from one region to another play a role^{22,33}.

Despite the fact that most occurrences of toxoplasmosis in humans are asymptomatic, approximately 10% of cases could potentially show symptoms such as lymphadenopathy and ocular difficulties²⁴. Since tachyzoite is one of the infectious stages of *T. gondii*, has the ability to cross the placenta and eventually infect the fetus, it is crucial to take into account the relevance and likelihood of infection among seronegative women who are infected during pregnancy¹⁵.

Furthermore, the stage of pregnancy at which the infection occurs is an essential and critical factor in determining the severity and duration of the congenital infection. More precisely, the risk of developing the disease during the end-stages of pregnancy is considerable, perhaps reaching 80%, and vice versa during the first trimester, where the probability is believed to be about 20%. Despite this, the consequences and risk to the fetus are heightened when the infection occurs during the early stages of gestation^{15,29}.

It is now obvious that the significance of this disease arises from its possibility of being passed from an infected mother to her fetus. This is especially concerning as it can lead to serious birth defects or, in some cases, even miscarriage. According to some reports, 5–15% of infected fetuses die, 10–13% has symptoms that might lead to moderate-to-severe impairment, and 8-10% of infected toddlers get eye problems and brain damage. These devastating figures should not be taken lightly, as the effects of toxoplasmosis can be long-term and even lifelong³⁵. It is worth noting that this is common since oocysts are ubiquitous in the environment and exceedingly common among stray cats and even domesticated, which may be found in almost any surrounding region due to their ability to survive under harsh environmental circumstances^{10, 12}.

In the United States, between 400 and 4,000 instances of congenital toxoplasmosis are documented annually. Infection with *T. gondii* has been found in 15% of childbearing women aged 25 to 44 years. This startling result highlights the need for more public education about the potential hazards of toxoplasmosis, particularly among women of childbearing age^{17,20}. Numerous investigations on the seroprevalence of *T. gondii* infection in pregnant women and women who have undergone abortions have been conducted in Palestine.

According to Al-Hindi and Lubbad (2009), among 312 women who had miscarried in Gaza, the prevalence of *T. gondii*-specific antibodies was found to be 17.9% for IgG and 12.8% for IgM. In Hebron, Palestine, A considerable seroprevalence of 27.9% was discovered in 204 pregnant women, with rural women having a higher incidence than urban women do do. On the hand, Al-Jarousha (2012) reported 30.9% seropositivity among 255 pregnant women in Gaza^{3,4,6}.

The purpose of this questionnaire-based study is to provide a detailed assessment of the level of knowledge and awareness, as well as a determination of potential risk factors for

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toxoplasmosis among Palestinian women of childbearing age in Gaza City.

The study found that there is a statistically significant relationship between the toxoplasmosis level of awareness among our target group and each of the following factors; age, occupation, educational qualification, prior obtaining of information, and instructions regarding toxoplasmosis.

MATERIALS AND METHODS

Ethical Approval: The Ethical Research Committee of the Islamic University of Gaza has approved the current study dated on July 4, 2021.

Study area and characteristics: The questionnaire was distributed in Gaza city, the main city in the Gaza Strip, which is in southern Palestine (Fig.1). The distribution encompassed many neighborhoods and blocks throughout the city. Moreover, it was disseminated in institutions (the Islamic University, Al- Al-Azhar University, and Al-Aqsa University) in the western part of the city, as well as in several outpatient clinics and primary care facilities. Distribution was broadened to include housewives and women who frequented city public facilities. According to the Palestinian Central Bureau of Statistics (PCBS) for 2021, Gaza is 45 square kilometers in area and has a population of approximately 650,000 people. It is also one of the most densely populated cities on the planet, with a population density of nearly 13,000 people per km² in the year 2017^{13, 26, 28}.

Figure 1. The map of the Gaza Strip ².



Sample population and size: The research focused on females between the ages of 15 and 49 years old, since pregnant women are one of the most significant groups thought to be vulnerable to toxoplasmosis. This age group accounts for 24.1% of Gaza City's total population ²¹. For robust questionnaire sample findings, the validity of the respondents' age component was checked, and only target age replies were considered. Aside from the age and gender criteria, no further selection considerations were taken into account. The sample size calculation method used in this investigation was similar to that utilized in a study conducted by Taherdoost (2017), with the following equation³²:

$$n = \frac{p(100-p)z^2}{E^2}$$

n is the required sample size.
 P is the percentage occurrence of a state or citation.
 E is the percentage maximum error required which was taken as 0.05.
 Z is a Z- value corresponding to the 95 % level of significance. Whereas Z-value equals 1.96 in the case of a 95% degree of confidence, the second component of the equation is P, where P is preferable to be 50%, as this will lead to a larger sample size, which will then be more representative⁷. According to the aforementioned, the sample size was calculated as follows:

$$n = \frac{0.5(1-0.5)(1.96)^2}{(0.05)^2}$$

n = 384

Data collection: The data was collected by distributing the questionnaire to a supposedly representative sample of women from our target cohort in Gaza City. Because Arabic is the spoken language among the target group, the questionnaire material was written in Arabic to promote easily understood questions and relevant answers. In addition to the introductory page, which stated the purpose of the research, the questionnaire was divided into four sections. The first section asked respondents for personal information, such as their age, educational background, health status, location of residence, and marital status. The second component assessed the respondents' prior knowledge and information about toxoplasmosis. Meanwhile, respondents were asked about their medical history and if they had previously been tested for *T. gondii* in the third part. Lastly, the fourth component focused on assessing various toxoplasmosis risk factors in the research area.

Statistical analysis: In the current study, SPSS version 15 was utilized to perform a chi-square test to determine the relationship between toxoplasmosis knowledge and awareness and the variables that included the following: age, marital status, occupation, pregnancy, miscarriage, scientific qualification, and receiving disease advice and instructions. When the p value is less than 0.05, the relationship is regarded as significant, whereas vice versa when the p value is greater than 0.05.

RESULTS

Sociodemographic data: The findings of this questionnaire survey showed that most respondents were between the ages of 21 and 30 years old, followed by the age group of 31 to 40 years old, and the lowest cohort was under the age of 20 years old (Table 1). In terms of educational qualifications, the majority of respondents had a bachelor's degree, while the bulk of their occupations were public employees, followed by a student cohort, and lastly, 56.00% of respondents were married. Regarding the respondents' health status, 8.50% have a chronic ailment, 16.25% are pregnant, and slightly over 11.00% have a psychiatric or behavioral issue (Table 1). Overall, the majority of respondents had attained a college degree and was employed in public positions. The vast majority of respondents, 83.25%, stated they reside in a high population density area, while 61.25% claimed they live in a good health care area. Furthermore, numerous women have said that they reside in a region with garbage cans nearby and a large number of stray cats.

Medical history of the respondents: It is worth mentioning that this survey's findings revealed that more than 25% of respondents had miscarriages. Unexpectedly, more than (78%) reported receiving no instructions or information about toxoplasmosis during the study period or from their treating physician, whereas merely (11.25%) had performed the required tests to detect toxoplasmosis and only (4.75%) reported being diagnosed with it. Table 2 contains a complete list of the respondents' medical backgrounds.

Knowledge about toxoplasmosis: Overall, the findings of this component of the survey showed that the overwhelming majority of respondents were either unaware of or had limited knowledge about toxoplasmosis, with more than 60% claiming to have never heard of the disease. The outcomes of the toxoplasmosis knowledge assessment are summarized in table 3.

Table 1: The distribution of the participants according to sociodemographic data and health status.

Age	18-20 years 70 (17.50)	21- 30 years 150 (37.50)	31-40 years 101 (25.25)	41-50 years 79 (19.75)
Scientific qualification	< General Secondary Certificate 26 (6.50)	General Certificate 110 (27.50)	Secondary 214 (53.50)	Bachelor's 50 (12.50)
Occupation	Student 142 (35.50)	Employee 150 (37.50)	Housewife 108 (27.00)	Others 10 (2.50)
Marital status	Single 164 (41.00)	Married 226 (56.50)		
Health status				
		Yes	No	
Chronic disease?		34 (8.50)	366 (91.50)	
Pregnancy?		65 (16.25)	335 (83.75)	
Psychiatric and behavioral changes?		45 (11.25)	355 (88.75)	
Home				
		Yes	No	
Overpopulated area?		333 (83.25)	67 (16.75)	
Adequate health services?		245 (61.25)	155 (38.75)	
Trash containers close to home?		211 (52.75)	89 (47.25)	
The spread of cats around the home?		314 (78.50)	86 (21.50)	

Table 2: The medical history of the respondents.

Question	Yes (%)	No (%)
Have you ever had a miscarriage?	105(6.25)	295(73.75)
Have you ever been tested for toxoplasmosis?	45(11.25)	355(88.75)
Have you been diagnosed with toxoplasmosis?	19(4.75)	381(95.25)
Have you had any symptoms after being diagnosed?	10(2.50)	390(97.50)
Have you ever received any toxoplasmosis-related instructions or information from your treating physician or during the study period?	86(21.50)	314(78.50)

Table 3: The knowledge about toxoplasmosis among the respondents.

The knowledge about toxoplasmosis No. (%)				
Have you heard about toxoplasmosis?	Yes 153 (38.25)		No 247 (61.75)	
The causative agent of toxoplasmosis?	Parasite 192(48)	Bacteria 120(30)	Fungus 17(4.25)	Virus 71(17.75)
The animals that play the crucial role in the transmission of toxoplasmosis in the environment?	Cats 319 (79.75)	Mice 50(12.25)	Insects 21 (5.25)	Others 10 (2.50)
	Yes		No	
Do you have an idea of how toxoplasmosis is transmitted to humans?	188 (47)		212 (53)	
Do you have any information about the effect of toxoplasmosis on the fetus?	169 (42.25)		231(57.75)	
Do you have any information about the prevention and control ways of toxoplasmosis?	140 (35.00)		260 (65.00)	

Risk factors and Practice: The findings of this survey indicated that 23.75% of respondents reared pets at home, while another 22% raised domestic cats and cared for them; yet, 16.75% consuming raw meat, and more than 20.00% had direct contact with soil. In contrast, 45.25% of those polled indicated they have a garden at home. Meanwhile, more than a quarter of respondents said there are sewage gathering pools near their residences, and more than 70%, 72%, said there are agricultural lands nearby. It should be noted that a quarter of the people questioned regard stray cats as pets and play with them. Figure 2 illustrates the risk factors for toxoplasmosis in women.

Knowledge, attitude, and practices determinants: The findings of this survey showed that (49.50%) of women between the ages of 31 and 40 had the most knowledge and awareness of the disease, with a small difference coming in second place among women between the ages of 21 and 30. Women under the age of 20 were found to have the lowest proportion of awareness of this disease, with only (17.14%) saying they were aware of

toxoplasmosis. The association between age and knowledge of toxoplasmosis is seen in table 4. These findings indicate a clear correlation between age and knowledge of toxoplasmosis.

Figure 2: The most prevalent risk factors for toxoplasmosis in the research area.

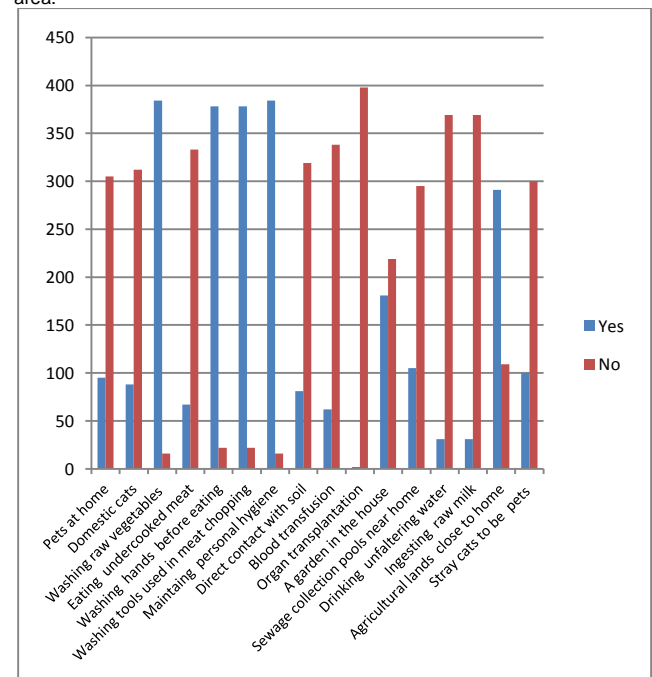


Table 4: The relationship between age and the level of awareness about toxoplasmosis among women of childbearing age.

Age group (Year)	No of Respondents	Aware (%)	Unaware%
17-20	70	12 (17.14)	58 (82.86)
21-30	150	73 (48.66)	77 (51.33)
31-40	101	50 (49.50)	51 (50.50)
41-50	79	18 (22.78)	61 (77.22)
Total	400	153(38.25)	247 (61.75)
χ^2	33.511		
P	P < 0.05. Statistically significant 0.000		

Table 4 shows that the relationship between the age of the respondents and their level of awareness about toxoplasmosis is statistically significant, as the p value was found to be 0.0000, whereby $\chi^2 = 33.511$.

Table 5 shows the relationship between several variables in respondent women and the level of awareness about

toxoplasmosis, as the table shows the relationship between, marital status, occupation, pregnancy, miscarriage, scientific qualification and receiving advice and instructions about the disease and the level of awareness among them.

Table 5: Characteristics of the studied population and the relationship between the illustrative variables and the level of awareness about toxoplasmosis in the study area.

Variable	No of questioned women.	No of who heard about toxoplasmosis%	χ^2	P
Married	164	62 (37.80)	1.546	0.462
Single	226	89 (39.38)		
Others	10	2 (20.00)		
Student	142	47 (33.09)	8.396	0.015
Housewife	108	35 (32.41)		
Employee	150	71 (47.33)		
Pregnant	65	26 (40.00)	0.101	0.751
Not pregnant	335	127 (37.91)		
Miscarried	105	35 (33.33)	1.457	0.227
Not miscarried	295	118 (40.00)		
< General Secondary	26	0 (0.00)	31.80	0.000
General Secondary	110	31 (28.18)		
Bachelor's	214	105 (49.06)		
Postgraduate	50	17 (34.00)		
Received disease awareness information and instructions	86	52 (60.46)	22.89	0.000
Not Received	314	101 (32.16)		

It is unambiguous from table 5 that the relationship between the level of awareness and knowledge of toxoplasmosis and each of the following variables: occupation, educational qualification, and receiving information and instructions about the disease were found to be statistically significant, as the P values were as follows: 0.015, 0.0000, and 0.000, respectively. On the contrary, the relationship between the level of knowledge and awareness of the disease and each one of the following variables: marital status, pregnancy, as well as exposure to miscarriage, was not statistically significant, as the p values were 0.462, 0.751 and 0.227, respectively.

DISCUSSION

In recent years, medical professionals have become increasingly aware of the risk posed by toxoplasmosis to pregnant women and their growing fetus^{15,23}. Disease transmission can be minimized by increasing disease awareness and knowledge, particularly among women of childbearing age. Furthermore, toxoplasmosis can indeed be avoided by excluding raw meat and thoroughly washing raw vegetables before consumption. While cleaning the cat's litter box, pregnant women should take precautions and avoid direct soil contact¹⁸. Anti-*T. gondii* antibodies have been detected in pregnant and miscarried women in the research region, according to several investigations. However, numerous studies carried out in the study region reveal the existence of this parasite, both in stray cats and raw vegetables, showing that, as previously stated, this infection has an influence on the environment and public health^{4,5,6,8}. The study's findings revealed that the majority of respondents, more than (61%), had never heard of this disease at all, implying that there is a lack of sufficient enthusiasm on the part of concerned authorities in spreading awareness and knowledge, as well as ways to control and prevent this disease, whether through various educational stages or through relevant authorities' activities.

Furthermore, the survey results revealed that (57%) of respondents were unaware of the risks of this infection to fetuses and (65.00%) were unaware of preventative and control strategies, raising the alarm and emphasizing the importance of shedding light on this issue, particularly in pregnant women. Similarly, the findings of this study revealed a lack of interest in identifying this disease in pregnant women, newborn infants, or even fetuses, as (880%) of the respondents had never been exposed to a toxoplasmosis test, despite the reality that this disease had been revealed during various investigations and research in the investigated area.

Moreover, (78%) received no instructions or information about this disease, whether from the treating physician or at the various educational levels, proving the failure of and criticizing the cultural and scientific elements of raising awareness of this disease by the relevant authorities. However, the findings of this study are consistent with those of previous studies conducted throughout the world to assess the level of knowledge and awareness of toxoplasmosis. For instance, an Egyptian study found that really just (3.20%) of 1079 female students were aware of toxoplasmosis, while another study conducted in Egypt too, found that this rate did not reach (9.90%)^{14,30}. Disappointingly, consciousness of toxoplasmosis was not greater in Malaysia; according to one of the studies, merely (3.40%) of female respondents were aware of toxoplasmosis, whereas the situation is substantially better in Iran, whereby (15.70%) of respondents claimed that they had previously heard of toxoplasmosis^{11, 34}. Whereas the level of awareness among pregnant women in Morocco was relatively higher, as one study found that slightly more than (40%) of respondents said they had heard about toxoplasmosis, which is consistent with the findings of this study, which found that (40%) of pregnant women respondents had knowledge about this disease, and this percentage is similar between the two studies, Moreover, the Moroccan researchers attributed these findings to the lack of *T. gondii* screening programs in Morocco, and the Moroccan study's explanations are comparable with the current study's reasoning in the vast percentage of respondents who had never heard of toxoplasmosis before¹⁶. The findings of this study also revealed that (34.70%) of non-pregnant women had heard of toxoplasmosis, showing that pregnant women in the study area have a little more knowledge than others, though this percentage requires more effort and awareness of the disease to avoid its dangers for this category of women. Curiously, according to this study, one-third of the women who had miscarried had heard of this disease, compared to (40.00%) of non-miscarried women. There is no other explanation than the failure of the relevant authorities to transmit knowledge and awareness about toxoplasmosis, particularly because the category of aborted women has already been reported as being infected with *T. gondii*⁴. When the results of this study are compared to the results of another study conducted at An-Najah University in the Palestinian city of Nablus, we find a great similarity in the results of the two studies, as the An-Najah University study revealed that (51.50%) of 976 female university students had never heard of toxoplasmosis, and (92.70 %) had not been tested for toxoplasmosis, compared to (88.75%) in the present study³¹.

In contrast to all previous studies, (84%) of 808 Italian women confirmed that they had previously heard about toxoplasmosis in a study conducted by Martini et al. (2020), and this difference between the results of the Italian study and other studies demonstrates the extent of interest in education and spreading awareness about toxoplasmosis in Italy compared to other countries¹⁹. In terms of marital status, the survey results indicated that more than (39%) of single women are aware of toxoplasmosis, compared to slightly more than (38%) of married women; this is merely explained by the fact that the bulk of the study participants are single women. There are 226 single women in the study group, but only 164 are married. This can also be attributed to the fact that the majority of single women are university students who have gained new knowledge about this disease as a result of their studies, and they have more time to learn and know, as opposed to married women who have been out of school for a long time and the circumstances of life have taken them away from information and knowledge. In terms of toxoplasmosis risk factors, this study found that more than (23.75%) of the respondents own pets, with (22%) possessing domestic cats. Even though both stray and domestic cats may transmit infection to humans, domestic cats have a higher propensity to spread the infection, which can be explained simply by the fact that domestic cats form more oocysts⁹. As a result,

more than one-fifth of respondents have an important risk factor for transmitting this parasite, which explains the need for increased awareness and education about the importance of proper breeding of these animals, while using gloves when cleaning the cat's litter box is strongly advised to avoid infection. Astonishingly, (16.75%) of respondents acknowledged consuming undercooked meat, despite the fact that eating raw or undercooked meat is not a common practice among Gaza city inhabitants. However, it can be argued that kebab, kofta, and shawarma are among the most popular cuisines in the city, and hence these foods might be deemed undercooked meat. It is worth noting here that, according to Abdel Razek et al (2014), in an Egyptian investigation, researchers were able to document the occurrence of *T. gondii* in various ready-made Egyptian dishes such as kebabs and koftas, implying that these are possible risk factors for *T. gondii* transmission to humans¹. Additionally, (20%) of respondents claimed they were in direct contact with the soil, which is considered a significant risk factor attributable to the potential for soil contamination with oocysts, and a quarter of respondents said they consider stray cats to be pets and play with them. Direct contact with soil and stray cats is regarded as a serious risk factor in general, and particularly in the study area, where *T. gondii* has already been documented in stray cats and vegetables. Where the researchers explained the existence of *T. gondii* in raw vegetables by contaminating water or soil with the oocysts, where many environmental factors such as rain and wind, as well as insects, play an important role in transporting these oocysts, thus contaminating human and animal food, this could provide a possible explanation for the transmission of toxoplasmosis to humans and animals in the study area^{5,8}.

The problem could simply be the lack of toxoplasmosis awareness, as a high percentage of respondents reported practicing high levels of hygiene, such as washing raw vegetables, hands, and tools used for chopping raw meat. This suggests that the level of hygiene and sanitation is satisfactory in the study region. The risk variables documented by this study are similar to the risk factors reported by other studies throughout the world, such as the study conducted at An-Najah University in Palestine, as well as those conducted in Morocco and Tanzania^{16,25,31}.

However, at different rates these differences can be attributed to differences in habits and customs, differences in climate and eating habits, differences in hygiene and infrastructure, as well as differences in how pets and stray animals, particularly cats, are handled, and finally, differences in the rates of awareness, knowledge, and culture of toxoplasmosis around the world. It is worth noting at the conclusion that there was no criterion for selecting the study sample other than age and gender, and therefore the research omitted the illiterate group who cannot read and write in Gaza City owing to their presence. An extremely small number is almost nonexistent. According to Palestinian Central Bureau of Statistics figures for the year 2020, the illiteracy rate in the Gaza Strip as a whole did not reach 2.00%, despite a population of approximately two million people. It is impressive that the illiteracy rate for the population age group of 30-44 years did not exceed 0.80%, and the rate of illiteracy for the population age group of 15-29 years did not exceed 0.70%. While the male illiteracy rate did not surpass 1.10% and the female illiteracy rate did not exceed 2.90%, overall and half of the illiterates are over 65 years old and consequently outside the study's target age range²⁷. Medical resources, diagnosis, and treatment must improve in developing countries. There are limited resources: access to medical and health resources; knowledge about disease; awareness, trainings, and awareness about health. The health literacy is mandatory for any disease and facilitate the patients with resources, databases and trainings about disease³⁵⁻⁴².

Furthermore, the research samples focused on female students in schools and universities, as well as female employees, in addition to housewives and women in public facilities, and the researchers did not encounter any illiterate women.

CONCLUSION

It was revealed that the majority of women in childbearing age in Gaza City has never heard of toxoplasmosis before and has limited knowledge of parasite transmission modes and prevention measures. In addition, the study confirms that eating undercooked meat, direct contact with soil, and handling domestic and stray cats are among the most significant and prominent risk factors in this target area, Gaza City. In addition, the study found that there is a statistically significant relationship between the toxoplasmosis level of awareness among our target group and each of the following factors; age, occupation, educational qualification, prior obtainment of information, and instructions regarding toxoplasmosis. On the other hand, the study concludes that there is no statistically significant relationship between the independent variable (awareness level of toxoplasmosis) and pregnancy, marital status, or abortion.

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