Prevalence of Toxoplasmosis Among Pregnant Women in Benghazi City / Libya

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ABSTRACT:

Toxoplasmosis is caused by *Toxoplasma gondii*, an obligate intracellular parasite that infects both humans and animals as a zoonotic pathogen widespread in nature. This study aims to determine the prevalence of toxoplasmosis among pregnant women in Benghazi City and identify risk factors that affect the infection rate. A total of 227 women who attended different private medical laboratories in Benghazi City to perform toxoplasma screening tests during pregnancy were selected. The duration of the study was from January 1, 2023, to October 1, 2023. In addition, patients were examined for antibodies to *Toxoplasma gondii* (IgG) and (Ig M) by the commercially available technique of ELISA. To be more specific, five age groups were used. Consequently, the total number of positive infected pregnant women was 44.1%, while the number of negative non-infected women was 55.9%. The seroprevalence of active toxoplasmosis was 44.1%, and chronic infections were 30%. The patient's age had no significant relationship with the T. *gondii* infection. To conclude, with the publication of health education and disease definitions, the incidence of infection will be reduced among pregnant women who are more susceptible to Toxoplasma infection. Therefore, pregnant women should be screened for toxoplasmosis regularly. This study aims to evaluate the seroprevalence of *T. gondii* infection among pregnant women of various age groups and to identify associations between infection and certain risk factors for infection.

KEYWORDS: Toxoplasmosis; Toxoplasma gondii; pregnant women; Benghazi; Libya.

INTRODUCTION

Toxoplasmosis is caused in humans and other vertebrate species by *Toxoplasma gondii*, an apicomplexan protozoan parasite with a heterogeneous life cycle, and the disease is very prevalent in humans around the world (1). In addition, the only known definitive host for *T.gondii* is a member of the Felidae family, which includes domestic cats and their relatives. This coccidian parasite can infect humans and warm-blooded animals as intermediate hosts (2). Significantly, humans can be infected with *T.gondii* by four major pathways: ingesting contaminated food or water by infected cat oocysts; ingesting or handling undercooked or raw meat containing tissue cysts; receiving organ transplants or blood products from donors with acute or latent toxoplasmosis; or, congenitally, through transplacental transmission of tachyzoites (3). Most human infections are asymptomatic. However, the parasite can often produce symptomatic disease with severe or even fatal clinical outcomes, especially in infected fetuses and immunodeficient individuals (4). T. gondii infection in fetal and neonatal animals may result in death or numerous congenital defects during pregnancy, such as hydrocephalus, disorders of the central nervous system, and chorioretinitis. Also, it can cause central nervous system manifestations such as Guillain-Barré syndrome (5) or cause brain abscesses in immunocompromised patients. Human toxoplasmosis prevalence in North African countries causes severe morbidity and financial losses. Thus, toxoplasmosis poses a serious risk to human and animal health. (10) released a review paper on toxoplasmosis and T. gondii infections in North Africa, affecting both humans and animals. The research was conducted in five North African nations: Morocco, Algeria, Tunisia, Libya, and Egypt. In Morocco, seroprevalence was between 36.7% and 62.1% in 2007 and 2017, respectively. Conversely, a serological test conducted in Algeria revealed that between 30% and 53.2% of people had T. gondii antibodies. Moreover, ELISA results show seroprevalence rates vary from 39.3% in the southern regions to 47.7% in the northern parts of Tunisia. Whereas, in Tripoli, Libya, 11 reported a 38.5% infection rate among women. Nationally, there aren't many studies on toxoplasmosis in Libya. A few recorded investigations on the prevalence rate of *T. gondii* in Libya were published by (6), who found that the disease affected 51.6% of adult males, 43.4% of adult females, 43.7% of schoolchildren, 18.14% of non-pregnant women, and 17.6% of women who reported spontaneous abortions. Toxoplasmosis in some cities near Benghazi City is more recent and updated, such as one study published by (7), who noted that the seroprevalence of IgG of *T. gondii* in El-Beida City is 26.86%, indicating a chronic infection. In contrast, the seroprevalence of IgM of *T. gondii* is 11.94%, considering it a new infection. In Sirte, Libya, (8) reported the toxoplasma infection rate was 35.92 % in males and 55.67 % in females. Finally, (9) claims that overall IgG seropositivity rates were detected in women with previous adverse pregnancies to be 44.8% in Benghazi city. Since approximately many people are thought to be chronically infected with *T. gondii,* toxoplasmosis is a major health concern not only in Libya but also in many parts of the world. In reality, several diagnostic techniques can be used to identify a human infection with *T. gondii*; the most significant of these is ELISA, which is one of numerous serological techniques to identify various antibody types (12). Regarding the formation of antibodies against *T. gondii,* IgM antibodies can be found within a week after the infection and will likely remain for months. Consequently, establishing an acute infection will require the detection of IgM. In contrast, the presence of IgG antibodies in infected patients can persist for many years. Therefore, it indicates an old infection (12). The purpose of this study was to ascertain the *T. gondii* seroprevalence of IgG and IgM among pregnant women in Benghazi city, Libya, as there is insufficient information regarding the prevalence of toxoplasmosis in that city.

MATERIALS AND METHODS

Study area: This study was conducted in Benghazi City, Libya. With an estimated population of 632,937 in 2019, Benghazi is the second-most populous city in Libya and is located on the Gulf of Sidra in the Mediterranean.

Study Samples: The population of this study was 227 pregnant women, recorded from many different private clinics. The sample ages were broken down into five age groups (group 1: 20–29 years, group 2: 30-39 years, group 3: 40–49 years, group 4: 50–59 years, and group 5: 60–65 years).

Collection of blood samples: about 5 ml of venous blood was collected under sterile conditions from each individual by medically trained nurses at the related clinics. After that, it was transported to the microbiology laboratory, where the blood samples were centrifuged at 4000 rpm for 5 minutes to separate the serum. Finally, analysis was completed using the ELISA (enzyme-linked immunosorbent assay) technique.

Data analysis was performed with SPSS (statistical package for social science) version 25, 1989, 2017; statistical significance was taken at $p \leq 0.05$.

RESULTS AND DISCUSSION

The current study is one of a series of studies in Libya that assess some behavioral factors that may influence the rate of *Toxoplasma gondii* infection in Benghazi and Libya.

The toxoplasma infection rate: It was found that 100 sera blood samples (44%) out of 227 tested were positive for toxoplasma gondii infection, while 127 sera blood samples (56%) were negative for *T. gondii* infection, as shown in Figure 1. The result was statistically significant ($P < 0.05$).

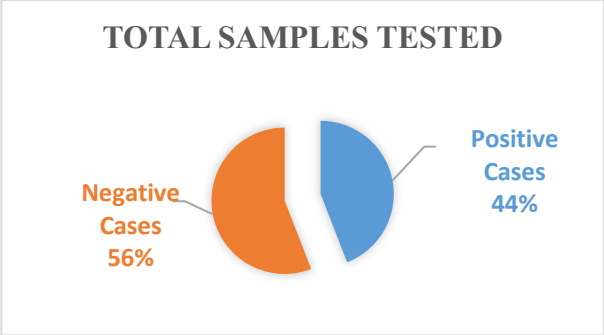

Figure 1: The prevalence of *T. gondii* (positive and negative samples) *infection* rate among total tested samples.

Percentage of IgG and IgM Toxoplasma gondii infection-positive cases: Out of 227 sera blood samples collected from pregnant women, a total of 86 (38%) and 14 (6%) IgG and IgM, respectively, were found to be seropositive for antibodies against *T. gondii* infection as shown in table 1 with a p-value of ($P < 0.05$).

Ig class	Total No. of samples	Total No. of positive samples & (%)
Ig G	227	86 (38) %
Ig M	227	14 (6) %

Table 1: Percentage of IgG and IgM Toxoplasma gondii infection-positive cases.

Relationship between the toxoplasma infection rate and age groups: It was clear from the present results shown in Table 2 that the sera blood sample showed an increase in the percentage of anti-*T. gondii* IgM within the age group 40–49 years (9,64%), in addition, to an increase in the percentage of anti-*T. gondii* IgG (28,33%). However, the age group between 60 and 65 showed the lowest percentage of anti-*T. gondii* IgM and IgG, being 17% and 33%, respectively. Therefore, there was an association between the prevalence of infection (regarding whether it

was a chronic or active infection) and age group, as shown in Table 2. Toxoplasmosis is recognized as one of the most significant members of the TORCH group, which also includes the most frequent infections linked to medical issues during pregnancy, including cytomegalovirus, herpes, and rubella (1). Furthermore, spontaneous abortion has been linked to primary maternal *T. gondii* infection throughout pregnancy (1, 2). The frequency of *T. gondii* among expectant mothers has been thoroughly investigated and recorded in several Libyan cities; these studies revealed notable regional variations in the infection's prevalence (3, 4).

Conversely, ELISA is the most widely used test to identify T. gondii antibody classes (1) serologically. This study's data, based on the ELISA technique, was collected retrospectively from different private medical laboratories in Benghazi, Libya, in 2023. The target subjects were pregnant women who were suspected of having a *T. gondii* infection. 100 positive samples were recorded out of 227 samples (44%), and 127 samples were negative for *T. gondii* infection out of 227 samples (56%), as shown in Figure 1. The current results were not very different from those observed in other previous studies from different regions of Libya. In Tripoli, 45% of seropositives for *T. gondii* infection were reported by (5). Another study, which was done on blood donors, found that 33.5% of blood donors had a T. *gondii* infection (6). In Sirte city, (7) claimed that *T. gondii* infection was positive for 45.5 percent of cases, while 54.50% were negative cases. Furthermore, there was a seroprevalence study of toxoplasmosis among Libyan pregnant women in Benghazi city, as (44.8%) of *T. gondii* IgG seropositive and (8.4%) of *T. gondii* IgM seropositive (8). These results matched the findings of the current investigation, which showed that *T. gondii* IgM was detected in 14 positive samples out of 227 (6%) with a p-value of 0.000. On the other hand, 86 out of 227 samples (38%) tested positive for *T. gondii* IgG, with a 0.000 p-value. Although these results are consistent with those of previous studies conducted in several Libyan locations, other regions of the country have low incidence rates. For example, one study, which was conducted in Benjawad, Libya, claimed that anti-*T. gondii* IgG and IgM antibodies were found to be positive in 37.14% and 3.57% of pregnant women, respectively(9). One further study was conducted in the Sebha region, which found that 36.84% of the sera from 190 pregnant women tested positive for anti-*T. gondii* IgG (10). Therefore, some reasons could be responsible for the differences and similarities in Toxo IgG and IgM seroprevalences from region to region within Libya, such as contact with animal species, the existence of cats on farms, drinking untreated water, becoming older, being in a climate that isn't too hot or cold, and cultural differences regarding the practice of food consumption and sanitation customs (5, 13). Even though the previous reasons may contribute to the toxoplasmosis incidence in Libya, the environmental conditions are more likely to be the reason for the fluctuating incidences in different parts of Libya.

According to age group, the serum blood samples revealed an increase in *anti-T. gondii* IgM percentage (9%) and *anti-T. gondii* IgG percentage (28%) in the 40–49 age group. Nevertheless, the age group ranging from 60–65 had the lowest levels of *anti-T. gondii* IgM and IgG, at 1% and 3%, respectively (shown in table 2). Therefore, age and seropositivity in this study showed a strong connection, suggesting that older populations are more vulnerable to the parasite than other age groups. These findings are consistent with those of (11) who found that infection rates rose with age and that the greatest incidence of infection was (69.3%) in the 46–50 age group.

		Total No. of samples & %	No. of positive IgM & % Out of 14	No. of positive IgG & % Out of 86
Age groups	20-29	71 (31.3%)	4 (29 %)	16 (19 %)
	30-39	74 (32.6 %)	0 (0%)	18 (21 %)
	40-49	55 (24.2 %)	9 (64 %)	28 (33 %)
	50-59	21 (9.3 %)	0 (0%)	21 (24 %)
	60-65	6 (2.6 %)	1 (7 %)	3 (3%)
Total		227	N = 14	N = 86

Table 2: The Relation between T. gondii-specific IgG and IgM and the Age of Tested Samples

CONCLUSION

This study confirmed that pregnant women are a risk group for toxoplasmosis. The publication of health education and disease definitions will reduce the incidence of toxoplasmosis among pregnant women in the coming years. It is highly recommended for pregnant women to be screened for toxoplasmosis to prevent any side effects that may occur during pregnancy period.

In addition, blood donors should be screened for toxoplasmosis since pregnant women may be transfused by blood that contains the effective stage of the parasite.

Competing Interests

I (author) declare that I have no conflict of interest.

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