

# Toxoplasma Gondii Seroprevalence Among Pregnant Women in Baghdad During 2021-2022

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## ABSTRACT

**Background & Objective:** Toxoplasmosis is a zoonotic infection caused by *Toxoplasma gondii*, a parasite that causes a variety of clinical symptoms in humans. It is a facultatively heteroxenous, polyxenous protozoon that has evolved several potential transmission routes within and between the host species. Infections caused by *Toxoplasma gondii* are more frequently seen in immunocompetent patients. The infection acquired by the mother during pregnancy puts the fetus at risk of congenital infection due to the parasite transmission across the placenta. The severity and frequency of infection are determined by the gestational age of the mother at the time of infection. The objective of this research was to study the toxoplasmosis infection in women, and to estimate the relationship between *T. gondii* infection and parameters including abortion time, chronic diseases, and age.

**Materials & Methods:** The case-control study was conducted on 50 healthy women (pregnant and non-pregnant) as control group and 135 women with abortion experience as case group at the Women's and Children's Hospital in Baghdad, Iraq from December 2021 until March 2022. The questionnaire was used to gather information from the women. The participant's name, age, gestational age, address, medications taken, medical history, previous abortions, and the date the sample was taken were all included. Under sterile conditions, five milliliters of the venous blood were drawn from each woman. The ELISA test was used to determine the level of anti-*T. gondii* IgM and IgG antibodies in serum samples.

**Results:** The anti-Toxoplasma IgM and IgG antibodies were found to be positive in 51% and 8% of the cases, respectively. However, the anti-*T. gondii* antibodies seroprevalence was 59% in women who had abortion. The healthy women had 0% for all antibodies.

**Conclusion:** Despite reporting the high rates of infection among women who had single abortions, the current study found no significant association between the percentage of infection and the number of abortions. The cause of high incidence among women who had abortion could be due to decrease in the immune system function.

**Keywords:** Abortion, ELISA, Seroprevalence, *Toxoplasma gondii* Antibody



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## Introduction

*Toxoplasma gondii* is a protozoan parasite that infects a wide variety of animal species, including humans (1-3). In addition to causing reproductive failure and birth defects in young animals, this parasite

has the potential to be a significant financial burden on farmers. This parasite has infected around a third of the world population, yet seroprevalence varies widely across countries (ranging from less than 10% to more

than 90%) and population groups (4-6). *T. gondii* infection is typically asymptomatic in healthy people, but it can cause significant illness in immunocompromised persons (7-9). Members of the *Felidae* family (domestic cats as well as their relatives) are the only definite hosts for the *Toxoplasma gondii*, because the oocyst is only seen in their excrements (10, 11). Intermediate hosts encompass all mammals, including humans, and birds (12). Toxoplasmosis infection can spread through goat and sheep meat. Humans catch the disease through eating raw or

undercooked meat, ingesting oocysts released into the environment by cats, or contracting the disease congenitally during primary maternal disease. Whenever a mother is infected throughout the first trimester, the risk of congenital disease is the lowest (10-25%) but more likely to cause major harm, whereas when the infection of the mother originates during the third trimester, the threat of congenital disease is the highest (60-90%) (13). Figure 1 shows the algorithm for the suspected maternal infection.

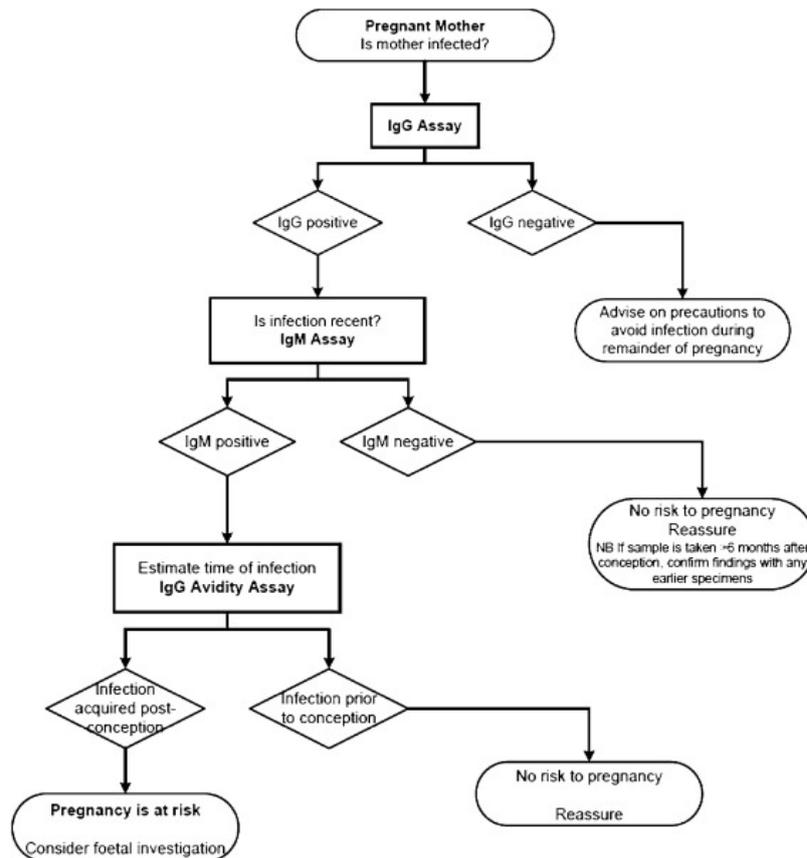


Figure 1. Diagnosis of possible *Toxoplasma gondii* infection in pregnant women (14).

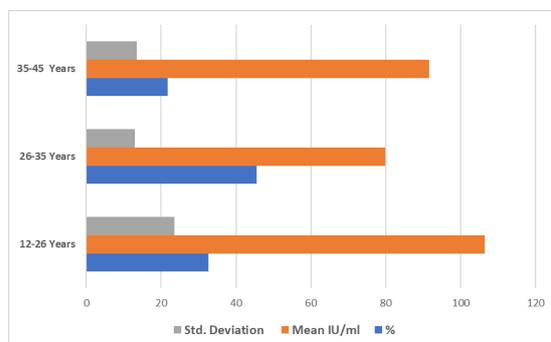
Blood transfusions and organ transplantation can also cause the spread of the virus (15). Infection with *Toxoplasma* in humans, particularly in individuals with weakened immune system, those with underlying diseases, kids, HIV/AIDS patients, and pregnant women can cause considerable harm (16, 17). Nearly, 70% of the affected people have no symptoms, therefore, immunocompromised people with this illness have a significant morbidity and fatality rate (18). Toxoplasmosis has a huge socioeconomic impact in terms of human misery and the cost of caring for the sick children, particularly those who are mentally retarded or blind. In several European nations, such as France and Austria, all pregnant women are routinely tested for *T. gondii* infection. Many other countries are debating the cost-benefit of such broad screening (4, 19-23).

Due to the climatic and geographical variations in the prevalence of toxoplasmosis, and the lack of precise and sufficient data on the role of the parasite in abortion, in this research, the association between seroprevalence of anti-*T. gondii* IgG and IgM antibodies level and several criteria, such as the abortion time, the presence of chronic conditions, and age were investigated amongst healthy women and women with first abortion experience in Baghdad, Iraq.

## Methods

The samples were gathered from 185 women. The research was conducted from December 2021 to March 2022. The patients were gathered from the women Guidance Division, Clinical Laboratory, and Laboratory of Virus Diseases at the Baghdad Women's

and Children's Hospital. Women with abortion experience, pregnant and healthy women, and non-pregnant and healthy women were the three groups of women studied. Women's information was collected via the questionnaire filled by the patient or laboratory technician. It included information such as the participant's name, age, gestational age, address, medications consumed, medical history, previous abortions, and the date the sample was obtained. Simple closed-ended questions about the established risk factors for the *Toxoplasma* exposure, as well as socio-demographic data, were included in the questionnaires. The venous bloods (5 ml) were collected into the tubes pre-labelled with an anonymized patient code. The blood samples were exposed to centrifugation at 3000 rpm for 5 minutes, after allowing to clot completely. The serum was extracted from the clot and kept at  $-20^{\circ}\text{C}$  in firmly clamped microfuge tubes. The frozen sera were later tested for the presence of *T. gondii* antibodies. An indirect Enzyme-Linked Immunosorbent Assay (ELISA) was used to assess the presence of *T. gondii* antibodies in the sera, according to the manufacturer's instructions (EUROIMMUN, D-23560 Lubeck, Seekamp 31, Germany), and were quantified using the optical density at 490 nm in an automatic plate reader (SPECTRA, Molecular Devices, USA). The sera with titers of  $\geq 20$  IU/mL and  $\geq 100$  IU/mL were considered positive for anti-*T. gondii* IgG and IgM, respectively.



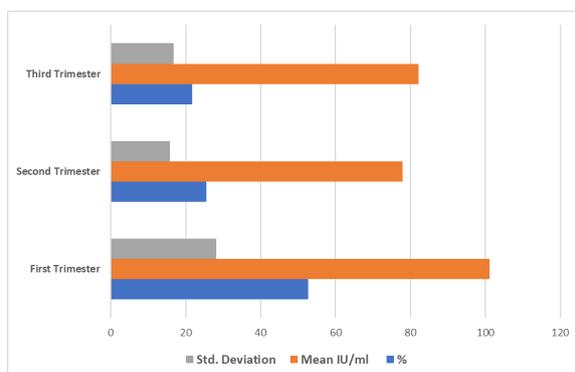
The ELISA results and data from questionnaires were analyzed employing Chi-square statistical test with 95% confidence interval using SPSS software version 21 (SPSS Inc., Chicago, Ill., USA). The chi-square test was performed to compare the results of different study groups. A statistically significant difference was indicated by a  $P < 0.05$  probability value. Where appropriate, a one-way ANOVA test was employed.

## Results

The seroprevalence of anti-*T. gondii* IgG and IgM antibodies were found to be positive in 8% and 51% of the patients, respectively. The overall anti-*T. gondii* IgG and IgM seropositivity was found to be 59% in women who had abortion. In this investigation, mixed seropositivity for IgG and IgM was not observed. Even though data analysis by chi-square indicated a significant correlation between different age groups and *Toxoplasma* infection, the age range dispersion of women who had abortion detected with anti-*T. gondii* IgG antibody represents a major boost in *Toxoplasma* IgG level in 12-26 years age range, accompanied by 35-45 years, and a younger age group of 26-35 years with Lysergic Acid Diethylamide (LSD) value of 14.7 (Figure 2).

**Figure 2.** Aborted women's age distribution in connection to anti-*Toxoplasma* IgG. Chi-square and P-value are 8.73 and 0.03, respectively.

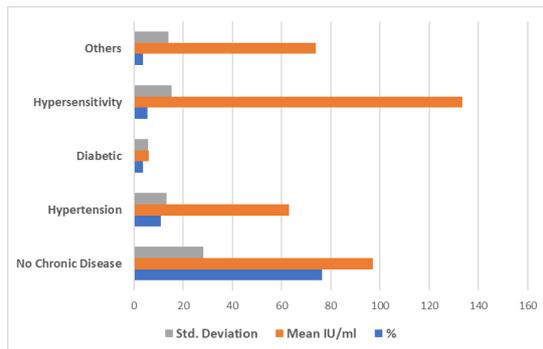
The time of abortion was classified as first, second and third trimester according to the time of pregnancy. At LSD value 11.87, the IgG levels were greater in the



first trimester, and there was a statistical association between the percentage of chronic toxoplasmosis infection and abortion time (Figure 3).

**Figure 3.** Prevalence of anti-*Toxoplasma* IgG antibodies in relation to the timing of abortion in infected women. Chi-square and P-value are 16.52 and 0.009, respectively.

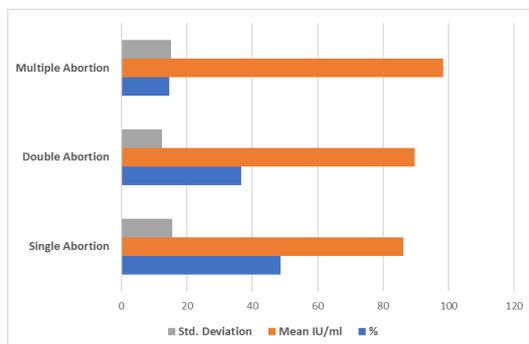
Additional chronic ailments, such as hypersensitivity, diabetes, hypertension, and others also affect some of the women who had abortion in



addition to toxoplasmosis. Hypersensitivity was shown to be at a greater level in women who had abortion, followed by hypertension (LSD 15.21) (Figure 4).

**Figure 4.** Aborted women's anti-Toxoplasma IgG antibody distribution in connection to chronic illness. Chi-square and P-value are 152.3 and 0.00051, respectively.

Also, it was found that women with multiple abortions have a significantly higher amount of anti-*T. gondii* IgG antibody. The majority of patients had a single abortion, accompanied by double and multiple



abortions, but none of these groups showed a significant level of anti-Toxoplasma IgG antibody level (Figure 5).

**Figure 5.** Anti-Toxoplasma IgG distribution in connection to the number of women who had abortion. Chi-square and P-value are 3.268 and 0.1411, respectively.

## Discussion

Serological procedures can help to diagnose *Toxoplasma gondii* infection by detecting antibodies in serum samples and determining whether the infection is chronic or acute. The incidence of the parasite *T. gondii* in women varies based on the climatic circumstances, health and food habits, financial environment, the level of education, and the age in different nations around the world. In the current research, 38.7% of the participants were tested positive for the anti-Toxoplasma IgG and IgM antibodies by ELISA technique (with 0% for all the antibodies in healthy women and 8% and 51% for IgG and IgM in women who had abortion, respectively which sums to an overall of 59%). The results were comparable with those of Al-Awadi *et al.* (2022) (23), which indicated that the seroprevalence of Toxoplasma IgG antibody was 59%, whereas the seroprevalence of Toxoplasma IgM antibody was 8% among women in Baghdad who had a history of spontaneous recurrent miscarriage. Using immunohistochemistry analysis for the identification of antigen, Alsailawi *et al.* (2022) (24) determined that the prevalence of toxoplasmosis amongst women undergoing abortion in Baghdad was 21.67%. The frequency was determined to be 19.17%

when utilizing the ELISA approach to identify a particular IgM. According to the findings of Kheirandish *et al.* (2019) (25), women who had the first abortion had higher incidence of IgM antibody positivity than women with no abortion. The positivity rate for the women with the first abortion was 7.5%, whereas the positivity rate for women with no abortion history was 0%. The high percentage obtained in this study as compared to the present research may be attributable to a number of factors, such as the variation in geography, time, and size of the sample; these variables could suggest a smaller proportion in the current investigation. The anti-Toxoplasma antibody prevalence was found to be 41.66% in women who had abortion and 0% in control women using Latex agglutination test conducted in Babylon province previously (26). Although earlier studies have shown that older age groups are more susceptible to *T. gondii* infection than younger ones (27), this study indicated that infection rates were highest among those aged 26-35 and lowest among those aged 35-45. This high incidence of seroprevalence in the 26-35 age group could be attributed to more frequent contact with cats or infected vegetables. Similar to the result of Nazari *et*

al. (2018) (28), a high prevalence of seropositivity was seen in the 25-30 age range in Iran. In terms of abortion stages, this research found that women who had abortions within the first trimester of pregnancy had a higher incidence rate. The anti-Toxoplasma IgG antibodies were found to be more prevalent in the patients with hypertension than in other categories, according to the present research.

## Conclusion

The present research is one of the few in Iraq looking at the incidence of *T. gondii* infection in pregnant women, which is one of the most common clinical types of toxoplasmosis. If a woman gets infected with *T. gondii* for the first time while pregnant, she has the risk for transmitting the illness to her fetus, which could result in catastrophic fetal harm. Although the

current research indicated considerable infection rate in women who had single abortions, it found no meaningful association between the number of abortions and the frequency of infection. The reason for the high incidence of this infection among women who had abortions could be due to a decrease in immunity among pregnant women, as the time of the acute or reactivate chronic injury during pregnancy plays an important role in determining the fate of the fetus.

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## Conflict of Interest

The authors declare no conflict of interest.

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