

Seroepidemiology of *Toxoplasma gondii* Infection among Pregnant Women in Public Hospital in Khoy, Northwest of Iran, 2015–2017

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Abstract

Aims: *Toxoplasma gondii* is a protozoan parasite and congenital transmission, abortion, and prenatal mortality are major problems of this parasite. This study was carried out to determine the seroprevalence of *Toxoplasma* infection in the pregnant women, referring to Khoy Public Hospital, Iran, during 2015–2017. **Materials and Methods:** In this descriptive cross-sectional study, 3 ml of venous blood were taken from 1060 pregnant women and centrifuged; the collected sera were kept in a freezer at -20°C until testing. Then, samples were examined for the presence of IgG and IgM *Toxoplasma* antibodies using Autobio ELISA kit according to manufacturer's instructions. Data analysis was done using Chi-square test and SPSS-10 software. **Results:** Among 1060 serum samples of pregnant women, 38.2% were positive for anti-*T. gondii* antibodies. IgG and IgM titers of antibodies to *T. gondii* were positive in 36.6% and 1.2% of women, respectively. The incidence in women older than 30 years was 49.3%. The positive rate of IgG of pregnant women increased with age ($P < 0.05$). In women who were living in the village, the prevalence was 45.5% and in urban women, it was 21.5%; this difference was statistically significant ($P < 0.05$). **Conclusion:** The relatively high prevalence of *T. gondii* infection in this study showed that pregnant women infected with this parasite at an early age and it is important for pregnant women to prevent irreversible complications in neonates.

Keywords: ELISA, Iran, pregnant women, *Toxoplasma gondii*

INTRODUCTION

Toxoplasma gondii is a parasitic protozoan with a worldwide distribution. Almost one-third of the world population has *Toxoplasma*-specific antibodies. Consumption of raw or undercooked meat containing tissue cysts also soil, water, and vegetables contaminated with oocysts excreted by cats are two important ways for human infection with this parasite.^[1] Hence, eating habits and poor hygiene could be risk factors for infection to *Toxoplasma*. If seronegative pregnant women infected with *Toxoplasma* for the first time, likely transmission of parasites from mother to fetus leads to abortion and fetal malformations.^[2]

Since the diagnosis based on live parasites associated risks of infection and there is not the possibility of testing everywhere, many serological methods such as ELISA, indirect immunofluorescent (IFT) antibody, and hemagglutination to detect antibodies against *T. gondii* in pregnant women and other people developed and applied.^[3]

Some of these methods are used as a routine diagnostic tool for detection of patients and in screening epidemiological studies.

The seroprevalence of toxoplasmosis in pregnant women in different parts of the world has been reported from 1% up to 70%.^[2,4] The highest incidence has been reported among women at the marriage age in France (71%).^[5]

Previous studies in Iran, based on the geographical distribution of antibodies to *T. gondii* prevalence rate among pregnant women indicated that the North 48%–74.6%,^[6,7] Northwest 33%–44%,^[4,8] South 22%–37%,^[9,10] and the central parts 27%–54%^[11,12] had anti-*T. gondii* IgG antibodies.

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In recent decades with the development of health education and processing of meat, the prevalence rate has declined.^[13]

Using serological methods for epidemiological investigation are important for identification of susceptible pregnant women to *T. gondii* to the prevention of abortion and congenital toxoplasmosis.

Whereas epidemiological study of *Toxoplasma* infection among pregnant women has not been done in Khoy area and to estimate the significance of this problem in this area, this study was carried out to determine anti-*Toxoplasma* antibodies in pregnant women by ELISA method in Khoy city, Northwest of Iran.

MATERIALS AND METHODS

Patients and sampling

This descriptive cross-sectional study was conducted between March 2015 and February 2017. An amount of 3 ml of venous blood samples were collected from 1060 pregnant women that were referred to Ghamar Bani Hashem hospital. The patients were from Khoy areas and surrounding villages (including 585 urban and 475 rural people). These women were in the first quarter, second, and third pregnant stages.

Blood samples were centrifuged at 3000 rpm for 10 min; then, serum was removed, and they were kept at -20°C until testing. For absorbance reading, an automatic ELISA reader (Stat Fax 4200, China) was used at 450 nm. Then, samples were examined for the presence of IgG and IgM *Toxoplasma* antibodies using a commercial ELISA kit (Autobio, China) according to manufacturer's instructions: index <0.8 IU/ml as a negative result, between 0.8 and 1.1 IU/ml borderline, and $1.1 \text{ IU/ml} < \text{index}$ (cutoff) was considered as a positive result. All tests were accompanied with the calibrator, negative, and positive controls.

In a questionnaire, demographic data, i.e., age, sex, medical history, and house location (rural or urban) were recorded.

Statistic analysis

Data analysis were done using Chi-square test and SPSS-16 software (SPSS Inc., Chicago, IL), and differences <0.05 were considered as significant.

RESULTS

A total of 1060 blood samples were obtained and were tested for *Toxoplasma* antibodies. The mean age of patients studied was 29 ± 2.73 (minimum 16 and maximum 42) years. Among pregnant women, 655 (61.8%) individuals were negative for anti-*Toxoplasma* antibodies. *Toxoplasma*-positive seroprevalence rate among pregnant women was 38.2% (405/1060). IgG and IgM antibodies to *T. gondii* were positive in 36.6% (388/1060) and 1.2% (13/1060), respectively. In 4 (0.38%) women, IgG and IgM were observed simultaneously.

The distribution of *T. gondii* antibody in pregnant women according to the demographic parameters such as age is shown in Table 1.

The lowest rate of seroprevalence (24.6%) was seen in women <20 years age group. This prevalence was 30.8% in 21–30 years age group and 49.3% in women older than 30 years. The seroprevalence rate of IgG antibody increased with age ($P \leq 0.05$).

Seroprevalence in women who were living in the villages and urban area were 45.5% and 21.5%, respectively, and this difference was statistically significant ($P \leq 0.05$). There was a significant difference ($P \leq 0.001$) between the seroprevalence of *T. gondii* infection in different months of pregnancy [Table 1].

DISCUSSION

Toxoplasmosis is one of the most prevalent protozoan parasitic infections of man, though its prevalence varies widely in different places. The first infection with *T. gondii* during pregnancy may be transmitted vertically by tachyzoite of this parasite, passed to the fetus, and can be resulted in severe damage to fetus including stillbirth, meningoencephalitis, and hydrocephalus or even abortion. Results of the present study showed that the prevalence of anti-*T. gondii* IgG antibodies were 36.6% in pregnant women attending Khoy Public Hospital, Khoy, Iran. This is important due to this fact that in this region, there is a high percentage of susceptible women (63.4%) who are at risk for congenital or acute *T. gondii* infection.

Infected animals harbor tissue cysts of *T. gondii* and human mostly infected by ingestion of raw or undercooked infected meat. Seroprevalence of toxoplasmosis in different countries is between 15% and 77%.^[14] In India 45%,^[15] Sweden 14%–25.7%,^[16] Spain 18.8%,^[17] Norway 10.9%,^[18] and Iran 30% of people showed IgG antibody to *Toxoplasma*. In the most regions, a lower seroprevalence has been reported in our study.^[8]

Detection of *T. gondii* antibody in patients may aid diagnosis, usually ELISA has been used to detect IgM and IgG antibodies. The prevalence of toxoplasmosis (IgG, IgM) in this study was 38.2% and it can be associated with weather conditions that are suitable for the survival of the parasite in this region, and these results are similar to results of other researchers.^[4,10,19] Some study reported a lower seroprevalence,^[16-18,20-22] while results of other studies were higher than our results.^[2,12,14,15,23-26]

In the present study, the rate of IgM for *Toxoplasma* infection rate is relatively low (1.2%) that was similar to other studies reported.^[14,19]

IgG antibody levels increased with age in this study. As women age, more than 30 years indicated high prevalence (49.3%) compared with women younger than 20 years (24.6%) ($P < 0.05$), which is consistent with the results of other studies^[4,19] whereas other studies did not report any significant relationship.^[4,21,27-29] In one study, the prevalence of infection in women between 15 and 45 years in Hamadan was 38.9%.^[4]

Table 1: Seroprevalence of toxoplasmosis in pregnant women according to demographic parameter in 1060 pregnant women in Khoy, 2015-2017

Factors	Age group			Habitant area		Gestational age		
	<20	21-30	30-50	Urban	Rural	First trimester	Second trimester	Third trimester
Seropositive, n (%)	61 (24.6)	94 (30.8)	250 (49.3)	126 (21.47)	216 (45.47)	63 (19)	172 (37)	117 (44.1)
Seronegative, n (%)	187 (75.4)	211 (69.2)	257 (50.7)	459 (78.53)	259 (54.53)	267 (81)	293 (63)	148 (55.9)
Total, n (%)	248 (100)	305 (100)	507 (100)	585 (100)	475 (100)	330 (100)	465 (100)	265 (100)

In another study, the prevalence in women aged 20–40 in Zurich reported (40%)^[30] and in French among marriage age women, seroprevalence has been reported (71%).^[5] It was well established that the seropositivity rate of *Toxoplasma* increased with age; this may be explained by the fact that older human has been exposed to infection for a longer time period.

In this study, the prevalence of infection in people living in rural areas was 45.5% and in urban, it was 21.5%. A significant difference between the prevalence of *T. gondii* was found in the rural and urban location that was consistent with other reports.^[8,21,27] In some studies, no significant difference in terms of location was found.^[19,31-33]

The difference between the results of the studies with others could be related to weather condition, food culture, study methods (IFT, ELIZA), and distribution of cats in this region.

CONCLUSION

The relatively high prevalence of *T. gondii* infection in our study can be related to the presence of a large number of cats in the villages and in the city that obstacles to movement in the individual's life and can infect food (meat, vegetables, and water surrounding environment). The result of this study showed that only 36.6% of pregnant women infected with the parasite at an early age and this is important for pregnant women and has the necessary care to prevent the development of the parasite in the blood of pregnant women in the seronegative individual. These can be done by increasing public awareness for parasite transmission ways, avoiding consuming raw or undercooked meat, and keeping cats away from home to irreversible complications in neonates and high costs of treatment prevented.

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Conflicts of interest

There are no conflicts of interest.

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