



Original Article

Seroprevalence and risk factors of *Toxoplasma gondii* infection among pregnant women in Sanandaj, west of Iran: A Cross-Sectional Study

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Summary

Toxoplasma gondii is considered to be a significant concern because of its zoonotic potential. In Pregnant women with toxoplasmosis, the parasite can be transmitted to the foetus causing severe complications. This study aimed to estimate the seroepidemiology of toxoplasmosis in Pregnant women who had referred to the Health Centers of Sanandaj in 2019. The study populations were women of child-bearing age (pregnant) aged between 15 and 44 years. Blood samples were collected from 146 women visiting six health centers during April to November 2019. Then, the levels of IgG and IgM antibodies against *Toxoplasma gondii* were determined by enzyme-linked immunosorbent assay (ELISA). Out of 146 samples, 44 (30.14%) and 4 (2.74%) cases were positive for IgG and IgM, respectively. The highest and lowest IgG antibody were found between the ages of 35-39 (64.28%) and 15-19 years old (7.14%), respectively. There was a significant relationship between the seroprevalence of *Toxoplasma gondii* infection and age ($P < 0.05$). Also, our results showed that all women had a history of raw vegetables consumption. No significant relationship was found between rate of toxoplasmosis and washing raw vegetable methods ($P \geq 0.05$). 69.86% of the selected women were seronegative. Preventive measures should be an infection. Our results confirmed that *Toxoplasma* is a common parasitic infection among pregnant women in Sanandaj. Thus, it is necessary to avoid the risk factors before and during the pregnancy of women via health trainings.

Keywords: Pregnant women, Sanandaj, Sereology, Toxoplasmosis

Introduction

Toxoplasma gondii is one of the most common parasitic infections of humans and warm-blooded vertebrates. It has a global distribution, and 30% of people are infected worldwide. The prevalence of *T. gondii* infection can be affected by some factors, such as hot and humid climates, dietary and

cultural habits, health conditions, and socio-economic status (Khademi et al., 2019). This infection is more common in moist, warm, and low altitude regions than in the cold climates and mountainous areas. Feline species are the definitive host and its intermediate hosts are a wide range of warm-blooded animals and humans (Razzak et al.,

2005). *T. gondii* infection is usually asymptomatic in immunocompetent individuals, but it is particularly dangerous for pregnant women because the prevalence of toxoplasmosis increases during pregnancy throughout the second and Trimesters of pregnancy and congenital infection. The severity of clinical disease in congenitally-infected infants is inversely related to the gestational age at the time of primary maternal infection with first-trimester maternal infection, leading to more severe manifestations (Hill and Dubey, 2002). The humans can also become infected by the ingestion of the oocysts derived from unwashed fruits and vegetables, food, or drinking contaminated water with cat feces, ingestion of inadequately cooked meat containing cysts, raw or undercooked meat infected with tissue cysts, unpasteurized milk consumption, contact with oocyst-contaminated soil and transplacental transmission (Abedi et al., 2015). The prevalence of *T. gondii* infection is widespread in humans and varies widely from place to place among different population groups (0 % -95%) (Gangneux and Laure Dardé, 2012). According to the previous serological studies in different areas in Iran, the prevalence of *T. gondii* infection in pregnant women has been reported to be as follows: In Hamadan 37% (Abedi et al., 2015), Aleshtar 36.2 % (Cheraghpour et al., 2009), Babol 6.60% (Kalantari, 2014), Rafsanjan 4.30 % (Zavari et al., 2015), and Delfan of Lorestan Province 7.30% (Ahmadpour et al., 2017). Furthermore, 75% of women were found to be negative for anti-Toxoplasma IgG antibodies by ELISA (Boothroyd, 2009); so, seronegative individuals are at risk for the disease as well as congenital toxoplasmosis in later stages of their life (Kalantari et al., 2014). To our knowledge, epidemiology and prevalence of toxoplasmosis in the Sanandaj area have not been previously examined. Therefore, this cross-sectional study was carried out to determine the prevalence of *T. gondii* infection in pregnant women of Sanandaj in 2019.

Materials and methods

This descriptive cross-sectional study was conducted to evaluate the seroepidemiology of toxoplasmosis in pregnant women who referred to the health centers of Sanandaj in 2019.

The sample size was calculated according to (Foroutan-Rad et al., 2016) using an expected Immunoglobulin G prevalence among the Iranian pregnant women was 41% (95%CI = 36–45%). A total of 146 pregnant women were included in the study with the age range of 15 - 44 years, and in the trimesters of pregnancy Blood samples were taken from each woman, and sera were separated and stored at -20°C until analysis in the laboratory of parasitology. Samples were examined by ELISA test using the kit manufacturer's manual (Toxo-IgG, IgM-Monobind Company). A questionnaire was designed to collect data on age, raw vegetables consumption, living place (urban or rural), and washing vegetables methods (using water only or using disinfectants). The collected data were analysed by SPSS software version 18 and the Chi-square test.

Results

A total of 48 serum samples were positive by ELISA test, and seroprevalence of 32.87% was detected. The present study revealed that 44 (30.14%) and 4 women (2.74%) had chronic and acute infections (high IgG and high IgM titers), respectively. Most of the pregnant women in this study were in the age range of 25-29 years (43.15%: 63/146), and the least number of them had the age range of 40-44 years (1.37%: 2/146). The highest IgG titer (64.28%) was observed in the age group of 35-39 years old, while the lowest IgG titer (7.14%) belonged to the age group of 15-19 years old. Thus, there was a significant relationship between age and IgG titer ($P < 0.05$) (Table 1). Besides, 104 (71.23%) and 42 (28.77%) women were urban and rural, respectively. Out of 38 IgG positive cases, 25 (17.12%) and 13 (8.9%) patients were urban and rural, respectively. However, statistical analysis indicated no significant differences ($P > 0.05$) between IgG titer in urban or rural women. Our current results also demonstrated that all patients

had a history of raw vegetable consumption. 108 (73.97%) and 38 (26.03%) patients had used water only and antiseptic solution, respectively. In the first and second groups, IgG titers were reported to

be 25.34% and 6.16%, respectively. No significant relationship was found between the *T. gondii* seroprevalence and washing vegetable methods ($P > 0.05$) (Table 2).

Table 1: Seropositivity for *Toxoplasma* antibodies in pregnant women of Sanandaj based on age.

Age	Percent/No	IgG positive / percentage to total sample	Percentage of IgG positive in each age group	Suspected IgG / percentage to total sample	Percentage of suspected IgG in each age group	IgM positive / percentage to total sample	Percentage of positive IgM in each age group	Suspected IgG / percentage to total sample	Percentage of suspected IgM in each age group
15-19	14(9.59)	1(0.68)	1(7.14)	1(0.68)	1(7.14)	0	0	0	0
20-24	29(19.86)	13(8.9)	13(44.83)	1(0.68)	1(3.45)	1(0.68)	1(3.45)	2(1.37)	2(6.9)
25-29	63(43.15)	14(9.59)	14(22.22)	2(1.37)	2(1.37)	1(0.68)	1(1.59)	1(0.68)	1(1.59)
30-34	24(16.44)	6(4.11)	6(25)	0	0	1(0.68)	1(14.17)	2(1.37)	2(8.33)
35-39	14(9.59)	9(6.16)	9(64.28)	2(1.37)	2(14.29)	1(0.68)	1(7.14)	0	0
40-44	2(1.37)	1(0.68)	1(50)	0	0	0	0	0	0
Total	146	44(30.14)	44(30.14)	6(4.11)	6(4.11)	4(2.74)	4(2.74)	5(3.42)	5(3.42)

Table 2: Risk factors associated to frequency and seropositivity for *T. gondii* in pregnant women of Sanandaj.

Variable	No/percentage	+IgG %	IgG - suspected %	+IgM %	IgM- suspected %
Living place	Urban	104(71.23)	25(17.12)	5(3.42)	4(2.74)
	Rural	42(28.77)	13(8.9)	1(0.68)	1(0.68)
Washing raw vegetable method	Water only	108(73.97)	37(25.34)	6(4.11)	5(3.42)
	Detergents	38(26.03)	9(6.16)	0	0

Discussion

Toxoplasma gondii is prevalent infection among humans, and its various prevalence has been reported throughout the world. Despite many studies, not all epidemiological risk factors for the occurrence of the disease have been identified. However, in the previous studies, different factors, such as environmental conditions, nutrition, and cultural habits, animal fauna, target population, host immunity status, different sample size, and various diagnostic techniques can be mentioned (Dubey, 2010; Abedi et al., 2015). The major routes for *Toxoplasma* transmission occur through the ingestion of tissue cysts in infected animal tissues, ingestion of oocyst from contaminated

water, vegetable, soil, or foods, and congenital transmission. The importance of toxoplasmosis is due to its irreversible complications in pregnant women. Maternal infection before becoming pregnant does not result in transmitting the infection to the fetus (Saadatnia, 2017), while congenital toxoplasmosis is caused by transplacental transmission of *T. gondii* in primigravida women (Fallah et al., 2006). The prevalence of toxoplasmosis varies in different geographical locations. Seroepidemiology of toxoplasmosis in the pregnant women of Norway has been reported to be 10.9% (Jenum et al., 1998). Furthermore, several studies have been conducted on seroepidemiology of toxoplasmosis in Iran,

such as Khuzestan (29.35%), Chaharmahal Bakhtiari (27.4%) (Yadyad et al., 2014; Naeeni et al., 2004). In other studies, the prevalence of toxoplasmosis in pregnant women in Sistan, Urmia and Kermanshah were found to be 64%, 33.5%, 77.4% and 62.2%, respectively (Jahantigh et al., 2020; Baillargeon et al., 2005; Mansouri et al., 2003).

The Current investigation is the first seroepidemiological report of toxoplasmosis in pregnant women of Sanandaj, western Iran. Our results demonstrated that 2.74% and 30.14% of the cases were found to be positive for anti-*Toxoplasma* IgM and IgG, respectively. Our findings were nearly close to the results of the previous studies conducted in Iran, such as Hamadan (Fallah et al., 2006), Urmia (Baillargeon et al., 2005), and Chaharmahal Bakhtiari (Naeeni et al., 2004); while, in another study, 18.2% of the cases were seropositive for IgM in Venezuela, which might be due to dissimilar conditions in the same geographical districts of Sanandaj and other studied regions (Díaz-Suárez et al., 2003). In some human societies, the prevalence of *Toxoplasma* infection is greater than 90% by the fourth decade of life (Kalantari et al., 2014). Our study showed that IgG seropositive rate increased with gestational age, and the women aging 35-39 years had a significantly higher seroprevalence (64.28%) ($P < 0.05$). The similar finding was recorded by other researchers (Sakikawa et al., 2012; Fallah et al., 2006; Mizani et al., 2017; Kalantari et al., 2014). Furthermore, in the meta-analysis study (Spalding et al., 2005) in line with our study, the seroprevalence of *T. gondii* IgG increased with age. The cause for this may be explained by the rising risk of exposure to infection sources throughout life. Beside in the current study, *T. gondii* seroprevalence was found to be 17.12% in rural and 8.9% in urban women, but the difference was not statistically significant ($P > 0.05$). In other similar studies, no relationship was seen (Naeeni et al., 2004; Mansouri et al., 2003; Ghasemi et al., 2010). However, in Japan, the relationship between the increasing percentage of *Toxoplasma* infection and living place was

significant ($P \leq 0.05$) (Sakikawa et al., 2012). Eating habits also play an important role in the acquisition of *T. gondii* infection. Results showed that 108 patients (73.97%) had washed vegetables with water only and 38 patients (26.03%) had washed vegetables with disinfectants. 25.34% and 16.16% of the patients in both groups were seropositive for IgG, respectively. No significant relationship was found between the parasite infestation rate and washing vegetable methods ($P > 0.05$). Our findings are in agreement with the results of the previous studies in Iran, like those of Ghadmagahi et al. (2013). In contrast, a significant relationship was observed between *Toxoplasma* infection and raw vegetables consumption by Fallah et al. (2006), Abedi et al. (2015), and Mizani et al. (2017). Oocyst viability and persistence in the soil can be affected by environmental factors, such as humidity and temperature (Shapiro et al., 2016). In this regard, our findings agree with the results of previous research conducted in cold and dry regions, such as Sweden with lower prevalence of the disease (Ljungstrom et al., 1995).

Beside 69.86% of the pregnant women did not have antibodies against *Toxoplasma*; hence, seronegative individuals are at risk for the disease as well as congenital toxoplasmosis in later stages of their life (Kalantari et al., 2014).

Conclusion

Results of the recent study confirmed that *Toxoplasma* is a common parasitic infection among pregnant women in Sanandaj. Consequently, identifying disease risk factors and taking preventive measures can help to perform effective strategies to monitor, prevent, or control epidemic. Thus, it is necessary to avoid the risk factors before and during the pregnancy of women via health trainings. knowledge among pregnant women about toxoplasmosis is low. Meanwhile, toxoplasmosis-preventive practices are generally suggested that providers should keep continue to offer education about practices that assist prevent foodborne diseases in general as well as

information about preventing toxoplasmosis particularly.

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Conflict of interests

There is no conflict of interest.

Ethical approval

The study protocol was approved by the Ethical Committee of the Medical Sciences Faculty of Sanandaj (IR.SNM.REC.1398.006).

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