



Tehran University of Medical  
Sciences Publication  
<http://tums.ac.ir>

## Iran J Parasitol

Open access Journal at  
<http://ijpa.tums.ac.ir>



Iranian Society of Parasitology  
<http://isp.tums.ac.ir>

### Short Communication

## Seroprevalence of *Toxoplasma gondii* among Pregnant Women in Ardabil, Iran (2021-2022)

Sahar Sadegi Hariri <sup>1</sup>, Zahra Heidari <sup>2</sup>, Shahram Habibzadeh <sup>3</sup>, \*Samira Shahbazzadegan <sup>4</sup>

1. Department of Medicine, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran
2. Department of Medical Microbiology, Parasitology and Immunology, School of Medicine, Ardabil University of Medical Sciences, Ardabil, Iran
3. Department of Infectious Disease, Imam Khomeini Hospital, Ardabil University of Medical Science, Ardabil, Iran
4. Department of Midwifery, School of Nursing and Midwifery, Ardabil University of Medical Sciences, Ardabil, Iran

Received 06 Jul 2022  
Accepted 19 Sep 2022

#### **Keywords:**

Seroprevalence;  
*Toxoplasma*;  
Toxoplasmosis;  
Pregnant women;  
Iran

#### **\*Correspondence Email:**

samirashahbazzadegan2000@yahoo.com

#### **Abstract**

**Background:** Toxoplasmosis during pregnancy can cause adverse outcomes. Regarding its importance in prenatal care, seroprevalence of *Toxoplasma gondii* infection among pregnant women was studied in Ardabil City, during 2021-2022.

**Methods:** In a cross-sectional study with a cluster sampling, 244 pregnant women that attended in health care centers of Ardabil City, Ardabil Province, Iran in 2021-2022 were selected. Serum samples were collected and Anti-*Toxoplasma* IgM (immunoglobulin M) and IgG (immunoglobulin G) was detected. Furthermore, a questionnaire filled for all participants during samples collection and risk factors assessed. Data were analyzed by SPSS software.

**Results:** Participant's age ranged from 16 to 43 years with average of  $23 \pm 5.24$  years. IgG anti-*T. gondii* antibody was detected in 22.1% of pregnant women (54/244). In none of participants IgM anti-*Toxoplasma* antibody was detected. There was no significant relationship between demographic variables and risk factors of toxoplasmosis with serology test results.

**Conclusion:** Approximately, 77.9% of pregnant women had no antibody against the *T. gondii* infection. Therefore, health education, counseling of pregnant women and screening in high-risk pregnant women is recommended to prevent from fetal complications.



## Introduction

**T**oxoplasmosis is a preventable infectious disease caused by the parasite *Toxoplasma gondii*. It can be infected humans by two major routes oral and transplacental transmission (1). Toxoplasmosis infects humans widely and is almost endemic in all parts of the world (2).

Toxoplasmosis in pregnancy may cause a serious effect on mother and particular on the fetus and congenital toxoplasmosis (3). Miscarriage, severe abnormalities, developmental delays, hydrocephalus, intracerebral calcification, blindness, and epilepsy intrauterine fetal death (IUFD) are from the complications caused by this parasite (4-5). It associates with a wide range of clinical symptoms and their pattern is under effect of age and immune status of the host (6-7). In 80%-90% of cases this infection may be asymptomatic with mild non-specific illness such as fever, malaise, and swollen lymph nodes. Its clinical aspects are serious in newborns and immunocompromised individuals (2).

Because of asymptomatic nature, lack of resources, and least priority in the health care policy, this infection is not considered in routine screening or surveillance programs (8). Determining the number of cases of congenital toxoplasmosis is more difficult than estimating seroprevalence of *T. gondii*. In the United States, 400 to 4000 infants are born with congenital toxoplasmosis annually (3). The global annual incidence is estimated to be around 200,000 cases, with high burdens in South America and some Middle East and low-income countries (3). Therefore, general information about the exact prevalence of the disease is doubtful. Dubey et al. reported the burden of toxoplasmosis in congenitally infected children is very high in Brazil. As it is estimated of 1 infected child per 1000 births, 2649 children with congenital toxoplasmosis are likely to be born annually in Brazil (9). The result of studies shows different prevalence in

different areas: 33% in Iran (10), 34% in Pakistan (11), 31% in Turkey (12), 55.8% in Romania (13), 31.5% in Austria (14), 13.8% in Italy (16), 82.6% in Lebanon (17). There were limited studies about anti-toxoplasmas antibodies prevalence in the Ardabil region. Daryani & Sagga (15) and Alimohammahi et al. (16) reported its prevalence 34.7% and 42.3%, respectively.

Today, Covid-19 has attracted all the attention and this subject lead to more ignorance. Toxoplasmosis screening is not clearly included in routine screening protocols in Iran (17).

Regarding to complications related to toxoplasmosis infection during pregnancy and lack of studies about its infection prevalence in Ardabil County to estimate of the seroprevalence of anti-toxoplasmas antibodies among pregnant women in recent years, this study was conducted with the aim of determination of the seroprevalence of *T. gondii* in pregnant women in Ardabil.

## Materials & Methods

Design of study was approved in Ethics Committee of the Ardabil University of medical sciences No IR.ARUMS.REC.1399.180. No additional blood sampling and financial cost were imposed on the participants.

This study was conducted as a cross-sectional during 2021-2022. The study population was all pregnant women who attended to the outpatient in the health care center. The numbers of samples were calculated 244, based on the statistical formula for sample size. Inclusion criteria was pregnant woman with the gestational age of less than 14 weeks and first referring to laboratory tests as routine prenatal care. These numbers were divided into 39 prenatal health care centers, according to the cluster sampling, population covered by each health center. After the achievement informed consent form, a questionnaire was

filled at the time of sample collection. The questionnaire consisted of two parts: part I including mother's age, height, weight, job, location, abortion, number of family members, number of children, and part II consist of information about risk factors of *T. gondii* such as eating raw meat, eating raw vegetables, gardening without gloves, caring of cat. Blood samples were taken from mothers at the same time as the first routine pregnancy tests. All of the pregnant women were tested for specific IgG and IgM of *T. gondii* antibodies.

For measurement of IgG and IgM antibodies in serum samples against *T. gondii*, the ELISA kit (Pishtazteb, Iran) used. The interpretation of the results was considered according to the manufacturers recommendations.

Data were statistically analyzed using SPSS v 21 software (IBM Corp., Armonk, NY, USA).

The Chi-square and *t*-test and descriptive methods were used for data analysis. The significant levels of 0.05 were used for all statistical analysis.

## Results

From 244 pregnant women, the youngest participant had 16 years and the oldest one had 43 years old with an average of  $23.06 \pm 5.24$  years. The average of weight and height of participants were  $70.23 \pm 11.85$  kg and  $163.06 \pm 19.76$  cm, respectively.

Most of participants were housewife, diploma, had 2 times pregnancy, with 8 weeks gestational age, and had two children. 37 women had stillbirth and 49 women had abortion history (Table 1).

**Table 1:** Demographics characteristic of studied pregnant women

| <i>Variable</i>       | <i>Number (%)</i> | <i>Variable</i> | <i>Number (%)</i>      |             |            |
|-----------------------|-------------------|-----------------|------------------------|-------------|------------|
| Job                   | Housewife         | 226 (92.6)      | < 9                    | 173 (70.90) |            |
|                       | Employ            | 9 (3.7)         | Gestational age (week) | 9-12        | 59 (24.15) |
|                       | Student           | 7 (2.9)         |                        | 12          | 10 (4.15)  |
|                       | Nongovernmental   | 2 (0.8)         |                        | > 12        | 2 (0.8)    |
| Education             | Under diploma     | 41 (16.8)       | No child               | 90 (36.9)   |            |
|                       | Diploma           | 151 (61.9)      | Number of children     | 1           | 120 (49.2) |
|                       | Bachelor          | 44 (18)         |                        | 2           | 31 (12.7)  |
|                       | MSc and Higher    | 8 (3.3)         |                        | 3           | 3 (1.2)    |
| Number of pregnancies | 1 time            | 80 (32.7)       | yes                    | 37 (15.1)   |            |
|                       | 2 time            | 118 (48.3)      | Stillbirth             | no          | 207 (84.9) |
|                       | 3 time            | 37 (15.1)       |                        | yes         | 49 (20.1)  |
|                       | 4 time and more   | 9 (3.9)         | Abortion               | no          | 195 (79.9) |

The results of independent T Test showed that there were no significant differences in serological IgG test based on age ( $P=0.753$ ), education ( $P=0.522$ ), Job ( $P=0.755$ ), weight ( $P=0.737$ ), height ( $P=0.826$ ), number of pregnancy ( $P=0.431$ ), number of child ( $P=0.986$ ), and gestational age ( $P=0.807$ ).

Overall, from the 244 participants, 54 (22.1%) had positive serology IgG and 190 (77.9%) were seronegative. All of participant's IgM test was negative.

Distributions of serological toxoplasmosis prevalence among pregnant women based on history of abortion and stillbirth is shown in Table 2. From the 49 women with abortion history, 15 women were seropositive. The rate of seropositive in women with stillbirth history was 11 persons out of 37. Based on the exact Fisher test, there was no significant difference in serological test among studied pregnant women based on stillbirth and abortion history ( $P=0.441$ , and  $P=0.125$ , respectively).

**Table 2:** Distribution of serology toxoplasmosis prevalence among pregnant women based on history of abortion and stillbirth

| <i>Serology Variable</i> |     | <i>Positive No (%)</i> | <i>Negative No (%)</i> | <i>Total</i> | <i>P-value</i> |
|--------------------------|-----|------------------------|------------------------|--------------|----------------|
| Abortion his- tory       | Yes | 15 (30.6)              | 34 (69.4)              | 49 (100)     | 0.125          |
|                          | No  | 39 (20)                | 156 (80)               | 195(100)     |                |
| Stillbirth               | Yes | 11 (29.7)              | 26 (70.3)              | 37 (27.8)    | 0.441          |
|                          | No  | 43(20.9)               | 163 (79.1)             | 206 (100)    |                |

The distribution of participant according to risk factors for toxoplasmosis is shown in Table 3. The results of Chi-Square test showed

that there was no significant difference among the seroprevalence of toxoplasmosis based on risk factors.

**Table 3:** Risk factors for toxoplasmosis in studied pregnant women

| <i>Row</i> | <i>Risk factors for toxoplasmosis in pregnant women</i> |     | <i>IgG</i>      |                 | <i>Total</i> | <i>P-value*</i> |
|------------|---|-----|-----------------|-----------------|--------------|-----------------|
|            |   |     | Positive No (%) | Negative No (%) |              |                 |
| 1          | Did you have a history of contact with cats?            | Yes | 5 (31.3)        | 11 (68.8)       | 16 (6.6)     | .363            |
|            |   | No  | 49 (21.5)       | 179 (78.5)      | 228 (93.4)   |                 |
| 2          | Do you have a history of keeping cats at home?          | Yes | 0 (0)           | 5 (10)          | 5 (2)        | .228            |
|            |   | No  | 54 (22.6)       | 185 (77.4)      | 239 (98)     |                 |
| 3          | Do you currently eat raw vegetables?                    | Yes | 53 (22.3)       | 185 (77.7)      | 238 (97.5)   | .744            |
|            |   | No  | 1 (16.7)        | 5 (83.3)        | 6 (2.5)      |                 |
| 4          | Do you have a history of contact with raw meat?         | Yes | 47 (23.6)       | 152 (76.4)      | 199 (81.6)   | .239            |
|            |   | No  | 7 (15.6)        | 38 (84.4)       | 45 (18.4)    |                 |
| 5          | Do you wash your hands before eating?                   | Yes | 45 (22.7)       | 184 (77.3)      | 238 (97.5)   | .186            |
|            |   | No  | 0 (0)           | 6 (100)         | 6 (2.5)      |                 |
| 6          | Do you use gloves when chopping raw meat?               | Yes | 24 (25)         | 72 (75)         | 96 (39.3)    | .385            |
|            |   | No  | 30 (20.3)       | 118 (79.7)      | 148 (60.7)   |                 |
| 7          | Do you have a long history of lymph nodes?              | Yes | 6 (22.2)        | 21 (77.8)       | 27 (11.1)    | .990            |
|            |   | No  | 48 (22.1)       | 169 (77.9)      | 217 (88.9)   |                 |
| 8          | Is your drinking water is purified urban type?          | Yes | 54 (22.1)       | 190 (77.9)      | 244 (100)    | -               |
|            |   | No  | 0 (0)           | 0 (0)           | 0 (0)        |                 |
| 9          | Do you have a history of keeping live-stock?            | Yes | 1 (50)          | 1 (50)          | 2 (.81)      | .340            |
|            |   | No  | 53 (21.9)       | 189 (78.1)      | 242 (99.2)   |                 |

\*Chi-Square test

## Discussion

Results of this study showed that the anti *T. gondii* IgG antibodies were detected in 22.1% Ardabilian pregnant women (54/244). *Toxoplasma* IgG and IgM seroprevalence differs in various regions of Iran and in throughout the world. The anti *T. gondii* IgG antibodies were observed in above 50% of studied population (18-21), while prevalence of 20-50% reported

by other researchers (2, 4, 16, 22-32). The prevalence of less than 20% observed in the study of Mousavi et al (10).

In the other hand, the anti *T. gondii* IgM antibodies prevalence of up to 4% was reported in some studies (19, 21, 22, 26, 30,32), but other researchers observed lower than 4% (10, 16,18, 23, 25). In other studies none of participants had anti *T. gondii* IgM antibodies (20,

24, 27, and 28), that is in accordance with the results of current study.

According our results, the prevalence of *Toxoplasma* seropositivity in Ardabil city is lower than other reports. This could be due to the cold weather of the region. This infection is more common in hot humid areas (2, 33). Another probable reason is that the study was conducted in the urban area. In urban area people have no deal with agricultural works and less contact with soil. Agricultural activity and contact with soil increased anti-*toxoplasma* antibody (2). Different regions of the world may benefit from different types of care; therefore, local climate, agricultural activities, and people's cultural attitudes should be considered in toxoplasmosis prevention strategies (34).

There was no significant difference in prevalence of *T. gondii* of participant based on age of mothers. This result was in accordance with other findings (2, 33, 34). In the studies of Bienkowski et al. (1) and Nowakowska et al. (4) the relationship between age and serological test results was direct and significant, that are in opposition with our results. The older women were seronegative for the anti *T. gondii* IgG antibodies (1).

In the present study there was no significant difference in prevalence of *T. gondii* antibodies of participant based on education of women. This result is in contradiction with the results of Sharifi et al. that reported a significant relationship between education and prevalence of *T. gondii* (22).

In our study, the difference in serology of toxoplasmosis based on gestational age was not significant that is in accordance with the results of Laboudi et al. (2). A meta-analysis confirmed the concept of trimester of acquisition risk, as the transmission at 13 weeks, 26 weeks, and 36 weeks was found to be approximately 15%, 44%, and 71% respectively (35).

There was no significant difference in serology test results of pregnant women based of number of pregnancy and number of child in

this study. This result is in agreement with the results of Laboudi et al. that reported instead of higher prevalence of seropositivity in multiparous women, the difference was insignificant among participants (2).

In the present study, it was not significant difference between a history of close contact with cat, raw vegetable and meat consumption. Toxoplasmosis was more common among low education level persons, consumers of raw meat and vegetable and cat holders (32) there was no significant relationship between mother's job and *Toxoplasma* IgG, according to our study (22).

In present study, the difference in serology of toxoplasmosis based of history of abortion and stillbirth was not significant. This result was in accordance with the results of Laboudi et al. (2) and Saki et al. (36) that did not observe significant relationship between abortion and serology. 19.2% of participants had abortion history and 75% of them were seropositive, that is in contradiction with our results (33). Parvin et al. showed a significant relation between low birth weight and serology results and all of LBW infants had negative IgG test (8).

The results of this study showed that the highest frequency of toxoplasmosis risk factors was consumption of raw vegetables. There was no significant relation between serology test results and risk factors of toxoplasmosis. This was in opposition with the results of Adunga et al. who declared that 73% of raw vegetable consuming women are seropositive (33). This study also reported a significant relationship between drinking water source and serology that is in contradiction with our results.

Regarding to uncommon routing screening of toxoplasmosis antibody among pregnant women in Iran, promotion of social awareness and prevention strategies is necessary. Wehbe et al. also pointed out hygiene measures is primary prevention of toxoplasmosis during pregnancy (37).

## Conclusion

A high percentage of pregnant women in Ardabil (77%) are at high risk of toxoplasmosis. Considering that is essential in health education and screening program, especially in pregnant women.

## Acknowledgements

We are thankful to all participants in this study. This study was an M.D thesis (Sahar Sadegi Hariri) from the Ardabil University of Medical Sciences, Ardabil, Iran. Financial source of the study was supplied by researchers.

## Conflict of Interest

The authors declare that there is no conflict of interests.

## References

1. Bieńkowski C, Aniszewska M, Kowalczyk M, et al. Analysis of Preventable Risk Factors for *Toxoplasma gondii* Infection in Pregnant Women: Case-Control Study. *J Clin Med*. 2022 Feb 19; 11(4):1105.
2. Laboudi M, Taghy Z, Duieb O, et al. *Toxoplasma gondii* seroprevalence among pregnant women in Rabat, Morocco. *Trop Med Health*. 2021; 49(1):21.
3. James D, Steer Ph J, Weiner CP, et al. High- risk pregnancy management options. 5th Edition. 2017, Cambridge University. ISBN: 9781108591706.Vole 1 pp712-16.
4. Nowakowska D, Stray-Pedersen B, Śpiewak E, et al. Prevalence and estimated incidence of *Toxoplasma* infection among pregnant women in Poland: a decreasing trend in the younger population. *Clin Microbiol Infect*. 2006; 12(9):913-7.
5. Arora N, Sadvovsky Y, Dermody TS, et al. Microbial Vertical Transmission during Human Pregnancy. *Cell Host Microbe*. 2017; 21(5):561-567.
6. Neu N, Duchon J, Zachariah P. TORCH infections. *Clin Perinatol*. 2015 Mar; 42(1):77-103, viii.
7. Smit GSA, Vu TLB, Do TD, et al. Prenatal diagnosis and prevention of toxoplasmosis in pregnant women in Northern Vietnam: study protocol. *BMC Infect Dis*. 2017; 17(1):364.
8. Parvin I, Das SK, Ahmed S, et al. *Toxoplasma gondii* Infection Is Associated with Low Birth Weight: Findings from an Observational Study among Rural Bangladeshi Women. *Pathogens*. 2022; 11(3):336.
9. Dubey JP, Lago EG, Gennari SM, et al. Toxoplasmosis in humans and animals in Brazil: high prevalence, high burden of disease, and epidemiology. *Parasitology*. 2012 Sep; 139(11):1375–424.
10. Mousavi M, Jamshidi A, Reisi JM. Serological study of toxoplasmosis among pregnant women of Nikshahr in 2012. *Razi J Med Sci*. 2014; 21(123):45–53.
11. Shah F, Hasnain J, Muhammad H, et al. Seroprevalence of human *Toxoplasma gondii* infection among pregnant women in Charsadda, KP, Pakistan. *J Parasit Dis*. 2018;42(4):554–558.
12. Tannverdi EÇ, Kadioğlu BG, Alay H, et al. Retrospective evaluation of anti-*Toxoplasma gondii* antibody among first trimester pregnant women admitted to Nenehatun maternity hospital between 2013- 2017 in Erzurum. *Turkiye Parazitol Derg*. 2018; 42:101–105.
13. Olariu TR, Ursoniu S, Hotea I, et al. Seroprevalence and risk factors of *Toxoplasma gondii* infection in pregnant women from Western Romania. *Vector Borne Zoonotic Dis*. 2020;20(10):763-767.
14. Berghold C, Herzog SA, Jakse H, et al. Prevalence and incidence of toxoplasmosis: a retrospective analysis of mother-child examinations, Styria, Austria, 1995 to 2012. *Euro Surveill*. 2016; 21(33):30317.
15. Daryani A, Saqqah M. Seroepidemiology of toxoplasmosis in girls referring to the laboratory of Ardabil health center for premarital tests. *Journal of Ardabil University of Medical Sciences*. 2004 Sep 10; 4(3):19-25.
16. Alimohammadi H, Fouladi N, Amani F, et al. Seroepidemiology of toxoplasmosis in women based on tests before marriage. *Journal of Ardabil University of Medical Sciences*. 2008; 8(4):408-413.
17. Borna S, Shariat M, Fallahi M, et al. Prevalence of immunity to toxoplasmosis among Iranian childbearing age women: systematic review and

- meta-analysis. Iran J Reprod Med. 2013; 11(11):861-868.
18. Aliabadi J, Khamesi S, Ghorbanpour H, et al. Seroprevalence of IgG, IgM and IgA against *Toxoplasma gondii* in pregnant women in first trimester in northern Khorasan Province, Iran. JNKUMS. 2017; 9 (2):243-252.
  19. Siyadatpanah A, Soufiani KB, Barzegar G, et al. Seroprevalence of *Toxoplasma gondii* infection among pregnant women in Amol, Northern Iran. Life Sci J. 2013; 10(2s):164-168.
  20. Kalantari N, Ghaffari S, Bayani M, et al. Serological study of toxoplasmosis in pregnant women in the city of Babol, northern Iran, 2012-2013. Journal of Ilam University of Medical Sciences. 2014; 22:102-108.
  21. Wam EC, Sama LF, Ali IM, et al. Seroprevalence of *Toxoplasma gondii* IgG and IgM antibodies and associated risk factors in women of child-bearing age in Njinikom, NW Cameroon. BMC Res Notes. 2016; 9(1):406.
  22. Sharifi K, Farash BR, Fatemeh TA, et al. Diagnosis of acute toxoplasmosis by IgG and IgM antibodies and IgG avidity in pregnant women from Mashhad, Eastern Iran. Iran J Parasitol. 2019; 14(4):639-645.
  23. Ghadamgahi F, Bahadoran M, Shariat-Bahadori B, et al. Study of Serological Toxoplasmosis and Risk Factors Associated with Infection in Women Referred to Labs of Northern Tehran, Iran. Journal of Isfahan Medical School. 2013, 31(248): 1257-1266.
  24. Sohrabi A, Samarbafzadeh A, Makvandi M, et al. A seroepidemiological study of Parvovirus B19, *Toxoplasma gondii* and *Chlamydia trachomatis* in pregnant women referring to Obs & Gyn ward of Ahwaz Imam Khomeini Hospital. Journal of Reproduction & Infertility. 2007; 8(2): 171-175.
  25. Tabatabaie F, Mafi M, Golestani M, et al. Seroprevalence of and risk factors for *Toxoplasma gondii* among pregnant women in Abyek township of Qazvin Province, Iran (2013). Asian Journal of Pharmaceutical and Clinical Research. 2015; 8(1):1-3.
  26. Cheraghipour K, Taherkhani H, Falah Mohammad S, et al. Seroprevalence of toxoplasmosis in pregnant women admitted to the health centers of Khorram-Abad City, Iran. Avicenna J Clin Med. 2010; 17(3):46-51.
  27. Pashaie Naghadeh, A, Dabirzadeh, M, Davoodi, T, et al. Seroepidemiology of Toxoplasmosis in pregnant women in Tabas City. mljgoums. 2015; 9 (2) :119-126[In Persian].
  28. Ghasemloo H, Ghomashlooyan M, Hooshyar H. Seroprevalence of *Toxoplasma gondii* infection among pregnant women admitted at Shahid Akbar Abadi hospital, Tehran, Iran, 2010-2013. J Med Microbiol Infec Dis, 2014, 2 (1): 16-18.
  29. Akhlaghi L, Shirbazou S, Maleki F, et al. Seroepidemiology of *Toxoplasma* infection in pregnant women in Qom Province, Iran (2010). Life Sci J. 2013; 10: 322-325.
  30. Sotudeh Jahromi A, Safa O, Zare S, et al. Anti-toxoplasmosis antibodies prevalence among pregnant women admitted to hospital in Bandar Abbas. J Hormozgan Univ Med Sci. 2002; 6(4):25-30.
  31. Jalai N, Olfatian Gilan b, Tavasoli A, et al. Seroepidemiology of toxoplasmosis among pregnant women referring to health center laboratories of Bojnurd in 2013. Journal of North Khorasan University of Medical Sciences 2013;5.
  32. Malary M, Hamzehgardeshi Z, Moosazadeh M, et al. Seroprevalence of *Toxoplasma gondii* infection among Iranian pregnant women: a systematic review and meta-analysis. East Mediterr Health J. 2018; 24(5):488-496.
  33. Adugna B, Tarekegn ZS, Damtie D, et al. Seroepidemiology of *Toxoplasma gondii* Among Pregnant Women Attending Antenatal Care in Northwest Ethiopia. Infection and Drug Resistance. 2021; 14:1295-1303.
  34. Ezatpour B, Zibaie M, Rahmati H, et al. Seroprevalence of toxoplasmosis in mentally retarded patients in Iranian rehabilitation centers. J Parasit Dis. 2015; 39(1):13-7.
  35. Thiébaud R, Leproust S, Chêne G, et al. Effectiveness of prenatal treatment for congenital toxoplasmosis: a meta-analysis of individual patients' data. Lancet. 2007; 369(9556):115-22.
  36. Saki J, Shafieenia S, Foroutan-Rad M. Seroprevalence of toxoplasmosis in diabetic pregnant women in southwestern of Iran. J Parasit Dis. 2016; 40(4):1586-1589.
  37. Wehbe K, Pencole L, Lhuire M, et al. Hygiene measures as primary prevention of toxoplasmosis during pregnancy: A systematic review. J Gynecol Obstet Hum Reprod. 2022; 51(3):102300.