

# Sero-epidemiological Study of Toxoplasmosis in Neonates and Postpartum Mothers Referred to Health Centers of Yazd in Iran during 2020

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## ABSTRACT

**Background and Aim:** Toxoplasmosis is a common parasitic infection that can endanger mother's and neonates' health during pregnancy. The disease is also prevalent in Iran. This study intended to evaluate the seroepidemiology of toxoplasmosis in neonates and postpartum mothers referred to health centers of Yazd in Iran in 2020.

**Materials and Methods:** Totally, 184 postpartum mothers and 184 neonatal umbilical cords in health centers of Yazd were evaluated for *Toxoplasma* infection through a specific IgM and IgG antibodies kit. The obtained data were analyzed by SPSS18.

**Results & Conclusion:** Out of 184 samples of postpartum mothers, 8 cases (4.35%) were seropositive, and 176 (95.65%) were seronegative for IgG antibody; moreover, 7 cases (3.80%) were seropositive, and 177 (96.20%) seronegative for IgM antibody. Also, 184 neonatal umbilical cords were IgM negative, and no toxoplasmosis infection was reported. No significant correlation was found between seroprevalence of *Toxoplasma* infection and caring for pets, consumption of raw meat, level of education, blood type, job, living area and type of delivery ( $P>0.05$ ). However, a significant correlation was identified between the number of deliveries and the prevalence of toxoplasmosis ( $P=0.014$ ). This study also illustrated a low prevalence of *Toxoplasma* infection in postpartum mothers and no congenital transmission of the disease in diverse health centers of the province. However, there was no statistically significant relationship between risk factors and the prevalence of *Toxoplasma*.

**Keywords:** IgG, IgM, postpartum mothers, seroepidemiology, toxoplasmosis

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## 1. Introduction

Toxoplasmosis is a common disease in all warm-blooded vertebrates and humans. It is caused by a protozoan called *Toxoplasma gondii*, an obligatory

intracellular parasite (1). Infection is transmitted to humans by foods such as undercooked meat or drinks contaminated with oocysts or tissue cysts. Also, organ

transplantation and congenital transmission are other ways of transmission this infection (2).

In the United States, approximately 400 to 4,000 babies are born with congenital toxoplasmosis each year. Involvement of the placenta triggers this infection (3). As the pregnancy progresses, the likelihood of acquiring an infection increases, and the severity of the clinical disease decreases (4). The affliction of pregnant women with this infection, especially in the first trimester of pregnancy, can lead to miscarriage or birth of a baby with complications of the nervous and ocular systems (5). A newborn whose mother has become infected with *T. gondii* during pregnancy can be born naturally but develops symptoms years after birth (6). In addition, infection with the parasite in AIDS patients, transplant recipients, and consumers of immunosuppressive drugs can be severe and thus life-threatening (7).

Owing to the wide range of toxoplasmosis infections in human societies, predominantly asymptomatic infection in pregnant women, determining the seroepidemiology of specific anti-toxoplasma antibodies in this group in different parts of Iran, including Yazd, and also investigating the potential incidence of infection in their infants are of critical significance. Therefore, conducting such studies can provide appropriate strategies for treating and preventing these complications. Consequently, due to the issue's importance, this study was designed and conducted to investigate the seroepidemiology of toxoplasmosis in neonates and postpartum mothers referred to health centers in Yazd, Iran, in 2020.

## 2. Materials and Methods

This descriptive cross-sectional study was conducted on samples selected randomly from patients referring to health centers in Yazd. Blood samples were taken from 184 mothers who had experienced delivery, out of whom 184 umbilical cords were obtained after signing written consent, and they completed the relevant questionnaire, including the following points (pet keeping,

consumption of raw meat, level of education, blood type, job, living area, number of deliveries and type of delivery). The serum was then separated and stored in the freezer at  $-20^{\circ}\text{C}$ . Once the samples were deleted, the IgM and IgG titers were measured using the instructions of the ELISA kit (*Anti-Toxoplasma gondii* ELISA (IgM, IgG) EI2410-9601 M & G, Euroimom, Germany), and the results were recorded. Data were then analyzed using SPSS18, and the findings were presented in frequency distribution tables. Appropriate statistical tests such as chi-square, T-test, and ANOVA were used for analysis. Ethics Committee for Human Research at Yazd Shahid Sadoughi University of Medical Sciences approved the study proposal with the ethics code: IR.SSU.MEDICINE.REC.1395.290.

## 3. Results & Discussion

A total of 368 subjects (184 mothers and 184 infants) were included in the study. The results of measuring maternal and IgG, neonatal IgM levels, and the presence or absence of toxoplasmosis are summarized in Table 1. As it can be observed, 8 (4.35%) and 7 (3.80%) mothers were seropositive in terms of IgG and IgM, respectively, but the others were within the normal range. IgM antibodies of all the newborns were also within the normal range.

The presence or absence of toxoplasmosis infection with underlying variables is shown in Table 2.

The effect of the type of delivery (normal or cesarean section) and the number of deliveries on *Toxoplasma* prevalence are summarized in Table 3. Normal delivery or cesarean section failed to increase or decrease the prevalence of toxoplasmosis ( $P=0.127$  and  $P=0.629$ , respectively). However, the results revealed that the number of deliveries significantly affects the prevalence of toxoplasmosis ( $P=0.014$ ).

Maternal and neonatal blood type did not significantly affect the prevalence of *Toxoplasma* ( $P=0.411$ ,  $P=0.295$  and  $P=0.770$ , respectively) as set out in Tables 4 and 5.

**Table 1.** Maternal IgG and IgM levels, neonatal IgM, and presence or absence of toxoplasmosis.

Variable	Mother				Neonate	
	IgM		IgG		IgM	
	Negative	Positive	Negative	Positive	Negative	Positive
Frequency	177	7	176	8	184	0
Percent	96.20	3.80	95.65	4.35	100	0

**Table 2.** Evaluation of the relationship between underlying variables and *Toxoplasma* prevalence

		IgG		P-value	IgM		P-value
		Positive	Negative		Positive	Negative	
<b>Living area</b>	Urban	7	160	0.496	7	160	0.632
	Rural	1	16		0	17	
<b>Education</b>	Illiterate	2	21	0.429	1	22	0.896
	High School	3	114		5	112	
	Bachelor	3	38		1	40	
<b>Job</b>	Master and higher	0	3	0.488	0	3	0.669
	Housewife	7	164		7	164	
<b>How to eat meat</b>	Employee	1	12	0.629	0	13	0.615
	Raw	0	9		0	9	
<b>Pet</b>	Baked	8	167	0.895	7	168	0.584
	Keeping	1	16		0	17	
	Not keeping	7	160		7	160	

**Table 3.** Effect of the type of delivery (normal or cesarean section) and number of deliveries on *Toxoplasma* prevalence

		IgG		P-value	IgM		P-value
		Positive	Negative		Positive	Negative	
<b>Type of delivery</b>	Normal	4	91	0.629	4	91	0.127
	Cesarean	4	85		3	86	
<b>Number of deliveries</b>	1	1	66	0.014	2	65	0.899
	2	3	44		3	44	
	3	0	37		2	35	
	4	3	18		0	21	
	5	1	6		0	7	
	6	0	2		0	2	
	7	0	2		0	2	
	8	0	1		0	1	

**Table 4.** Evaluation of the relationship between maternal blood type and *Toxoplasma* prevalence.

		IgG		P-value	IgM		P-value
		Positive	Negative		Positive	Negative	
<b>Blood type</b>	A+	1	48	0.552	0	49	0.411
	A-	1	7		0	8	
	B+	1	49		0	50	
	B-	2	8		2	8	
	AB	0	13		0	13	
	O+	3	46		4	45	
	O-	0	5		1	4	

**Table 5.** Evaluation of the relationship between neonatal blood type and *Toxoplasma* prevalence

		IgG		P-value	IgM		P-value
		Positive	Negative		Positive	Negative	
Blood type	A+	2	56	0.552	0	58	0.295
	A-	0	3		0	3	
	B+	0	45		1	44	
	B-	0	6		0	6	
	AB+	0	14		0	14	
	AB-	0	2		0	2	
	O+	5	45		6	44	
	O-	1	5		0	6	

*Toxoplasmosis* is common in Iran (8). Due to the harmful effects of this parasite in neonates, the identification of susceptible cases of acute infection during pregnancy should be considered to prevent *toxoplasmosis* and reduce congenital complications with contraceptive methods (9). This study demonstrated that among the mothers studied, 4.35% and 3.80% of them had high levels of IgG and IgM antibodies, respectively, and the other antibody levels were within the normal range. All the newborns were within the normal limits (WNL) in terms of IgM levels. A similar study by Anvaritafti & Ghafourzadeh in Yazd projected 32% prevalence of this infection in the studied population (10). Due to the great statistical population in their study, their reported prevalence was higher than what we observed in our study. Besides, our study showed a low prevalence of infection in women compared to the study conducted by Mohammadi et al. on females around the age of marriage (11). The highest prevalence of *toxoplasmosis* in Iran has been reported in northern temperate regions, compared to temperate and arid foothills (12). Its low prevalence in this study can be attributed to the climatic conditions of Yazd, which is unsuitable for developing oocytes. As a result, lower levels of IgG and IgM are normal in hot and dry climates compared to the country's northern regions. In a study conducted in Shiraz by Omidian et al., the prevalence of serum IgM in infants was reported as too low, which is almost in line with our research (13). In our study, no statistically significant relationship was observed between education level and *toxoplasmosis*, which is in line with the study conducted by Rostamzadeh et al., in Urmia (14).

Probably, differences in prevalence can be ascribed to the high level of public awareness and health status among educated people compared to illiterate people. Another evaluated variable was mothers' occupation, as Velasquez-Hernandez's study showed the importance of mothers being homemakers in the

higher prevalence of infection (15); however, no significant difference was observed in our study. Our study also suggested no significant relationship between raw or undercooked raw meat consumption and *Toxoplasma* prevalence. The result of our study was consistent with that of Mostafavi et al. (16). The lack of significant correlation in our study could be attributed to the low number of people who consume raw meat. One of the most important factors in increasing the prevalence of *Toxoplasma* infection is the close relationship with pets, especially cats as the hosts. In the present study, no statistically significant difference was identified between the two groups of people keeping cats and not keeping cats; this may be due to the small number of people who kept domestic cats in this study (17). In addition, Davoodi et al. detected no significant relationship between the prevalence of *toxoplasmosis* and the history of keeping cats at home. However, in some other studies, this relationship exists (18). The living area appears to be one of the most important risk factors for the prevalence of *Toxoplasma* infection. Therefore, this variable was evaluated in our probe, and people were divided in terms of being urban or rural and compared in terms of the prevalence of infection. This part of the study showed the prevalence of positive cases of IgG and IgM antibodies in urban residents being higher than that in rural residents. However, no significant difference was observed between urban and rural variables and the prevalence of *Toxoplasma*. These results were not consistent with those of Davoodi et al., who examined the prevalence of human *toxoplasmosis* in men and women referred to the central laboratory of Miyaneh city (18), but the results of our study were consistent with those of Daryani & Sagha in Ardabil (19). Another variable examined was maternal and neonatal blood type, which had no significant effect on *Toxoplasma* prevalence. In a similar study by Smael et al., (20) on women with miscarriage, no significant relationship was found between *toxoplasmosis* and each ABO

phenotype (20). The type of delivery (normal delivery or cesarean section) failed to have a significant effect on the prevalence of infection; this was consistent with that of Saki et al. (21). However, we showed that the number of deliveries exerts a significant effect on the prevalence of *Toxoplasmosis*, which is consistent with the study by Smereka et al. in Poland (22). Overall, the differences between the present study results and other studies are probably due to geographical and social differences, the type of meat consumed, and eating habits among different communities.

## 5. Conclusion

This study showed no congenital transmission and a low prevalence of *Toxoplasma* infection in postpartum mothers. This can be attributed to the impact of the study area, people's lifestyle, way of eating meat, and improper contact with pets, especially cats. The results also demonstrated no statistically significant relationship between the risk factors and the prevalence of *Toxoplasma*; however, more investigations are needed.

## Reference

- Rouatbi M, Amairia S, Amdouni Y, Boussaadoun MA, Ayadi O, Al-Hosary AAT, et al. *Toxoplasma gondii* infection and toxoplasmosis in North Africa: a review. *Parasite*. 2019;26. [PMID] [PMCID] [DOI:10.1051/parasite/2019006]
- Sukthana Y. Toxoplasmosis: beyond animals to humans. *Trends Parasitol*. 2006;22(3):137-42. [DOI:10.1016/j.pt.2006.01.007] [PMID]
- Ostrander B, Bale JF. Chapter 6 - Congenital and perinatal infections. *Handbook of Clinical Neurology*. 2019;162:133-53. [PMID] [DOI:10.1016/B978-0-444-64029-1.00006-0]
- Cook A, Holliman R, Gilbert R, Buffolano W, Zufferey J, Petersen E, et al. Sources of toxoplasma infection in pregnant women: European multicentre case-control study commentary: Congenital toxoplasmosis-further thought for food. *Bmj*. 2000;321(7254):142-7. [DOI:10.1136/bmj.321.7254.142] [PMID] [PMCID]
- Piao LX, Cheng JH, Aosai F, Zhao XD, Norose K, Jin XJ. Cellular immunopathogenesis in primary *Toxoplasma gondii* infection during pregnancy. *Parasite Immunol*. 2018;40(9):e12570. [DOI:10.1111/pim.12570] [PMID]
- Berrébi A, Assouline C, Bessières M-H, Lathière M, Cassaing S, Minville V, et al. Long-term outcome of children with congenital toxoplasmosis. *Am J Obstet Gynecol*. 2010;203(6):552. e1-e6. [DOI:10.1016/j.ajog.2010.06.002] [PMID]
- Basavaraju A. Toxoplasmosis in HIV infection: an overview. *Trop Parasitol*. 2016;6(2):129. [PMID] [DOI:10.4103/2229-5070.190817] [PMCID]
- Foroutan M, Dalvand S, Daryani A, Ahmadpour E, Majidani H, Khademvatan S, et al. Rolling up the pieces of a puzzle: A systematic review and meta-analysis of the prevalence of toxoplasmosis in Iran. *Alexandria J Med*. 2018;54(3):189-96. [DOI:10.1016/j.ajme.2017.06.003]
- Mizani A, Alipour A, Sharif M, Sarvi S, Amouei A, Shokri A, et al. Toxoplasmosis seroprevalence in Iranian women and risk factors of the disease: a systematic review and meta-analysis. *Trop Med Health*. 2017;45(1):1-13. [DOI:10.1186/s41182-017-0048-7] [PMID] [PMCID]
- Anvaritafti MH, Ghafourzadeh M. Seroepidemiology of *Toxoplasma* infection in pregnant women in Yazd in 2012. *J Toloo-e-Behdasht*. 2014;13(3(45)):116-25.
- Mohammadi A, Shojaee S, Salimi M, Zareei M, Mohebbali M, Keshavarz H. Seroepidemiological study of toxoplasmosis in women referred to Arak marriage consulting center during 2012-2013. *Iran J Public Health*. 2015;44(5):654.

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## Ethics approval

The authors have completely observed ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.).

## Conflict of Interest

The authors stated no conflict of interest.

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12. Daryani A, Sarvi S, Aarabi M, Mizani A, Ahmadpour E, Shokri A, et al. Seroprevalence of *Toxoplasma gondii* in the Iranian general population: a systematic review and meta-analysis. *Acta Trop*. 2014;137:185-94. [DOI:10.1016/j.actatropica.2014.05.015] [PMID]
13. Omidian M, Ganjkarimi AH, Asgari Q, Hatam G. Molecular and serological study on congenital toxoplasmosis in newborn of Shiraz, Southern Iran. *Environ Sci Pollut Res Int*. 2021;28(13):16122-8. [DOI:10.1007/s11356-020-11707-x] [PMID]
14. Rostamzadeh Khameneh Z, Hanifian H, Rostamzadeh A. Seroprevalence of Toxoplasmosis in Pregnant Women in Urmia, Iran. *Int J Enteric Pathog*. 2016;4(2):1-3. [DOI:10.17795/ijep33350]
15. Velázquez-Hernández N, Avilés Ávila AY, Rivas-González MA, Delgado-González SP, Alvarado-Félix GA, Alvarado-Félix Á O, et al. Knowledge and practices regarding toxoplasmosis in housewives: A cross sectional study in a northern Mexican city. *PLoS One*. 2019;14(9):e0222094. [DOI:10.1371/journal.pone.0222094] [PMID] [PMCID]
16. Mostafavi SN, Ataei B, Nokhodian Z, Yaran M, Babak A. Seroepidemiology of *Toxoplasma gondii* infection in Isfahan province, central Iran: A population based study. *J Res Med Sci*. 2011;16(4):496.
17. Fallah M, Rabiee S, Matini M, Taherkhani H. Seroepidemiology of toxoplasmosis in primigravida women in Hamadan, Islamic Republic of Iran, 2004. *East Mediterr Health J*. 2008;14(1):163-71.
18. Davoodi J, Sadagian M, Bahman Shabestari A, Rasouli S, Khodadadi A, Jafary K. Survey on serologic prevalence of human toxoplasmosis in males and females referred to central Medical Laboratory in the Mianeh city by Elisa method. *J Vet Clin Pathol*. 2012;6(1 (21)):1435-45.
19. Daryani A, Sagha M. Seroepidemiology of toxoplasmosis in women referring to the laboratory of health center in Ardabil for premarital medical examinations. *J Ardabil Univ Medical Sci*. 2004;4(3):19-25.
20. Smael BS, Palpitany SA, Rahim KHH. Association of Rhesus Blood Group (RhD) and Toxoplasmosis in Women with Miscarriage in Erbil. *Erbil J Nurs Midwifery*. 2018;1(2):94-100. [DOI:10.15218/ejnm.2018.12]
21. Saki J, Mohammadpour N, Moramezi F, Khademvatan S. Seroprevalence of *Toxoplasma gondii* in women who have aborted in comparison with the women with normal delivery in Ahvaz, southwest of Iran. *Sci World J*. 2015;2015. [DOI:10.1155/2015/764369] [PMID] [PMCID]
22. Smereka J, Szarpak L, Ruetzler K, Schacham Y, Smereka A, Dabrowski M, et al. A multicenter survey on toxoplasmosis knowledge among pregnant women in Poland (the TOWER study). *BMC Pregnancy Childbirth*. 2018;18(1):1-5. [DOI:10.1186/s12884-018-2031-7] [PMID] [PMCID]