

Seroprevalence of IgG and IgM of *Toxoplasma gondii* among pregnant women at El-Beida city-Libya

Corresponding Authors: Nouara Elazirg Elammari¹, Salem Ramadan Sariti² Hana Husieen Boba kr Muftah³ and Munay younus Al Abbar⁴

1- Department of Parasitology of Medicine faculty-Benghazi University, Benghazi-Libya.

2- Biology Department, Libyan Academy, Misurata-Libya.

3-Department of Parasitology- Medicine faculty-Omar Al Muktar University, El-Beida-Libya.

4-Department of basic medical science-faculty of Pharmacy- Benghazi University, Benghazi-Libya.

*To whom reprint requests should be addressed: e-mail: nouara.elammari@uob.edu.ly

Article Received: 31 August 2021, Accepted: 7 October 2021, Publication: 10 October 2021

Abstract

Introduction: *Toxoplasma gondii* which infects all warm-blooded animals including birds and mammals. Significant differences from region to region in the prevalence of *T. gondii* in Libya as it is in the other world parts. The detection of *T. gondii* infection in human can be performed by several types of the diagnostic methods, ELISA is the most important one of these methods which is one of a variety of serological methods to detect different antibody classes or antigens.

The aim of this study: To determine the *T. gondii* seroprevalence of IgG and IgM among pregnant women at El-Beida city in Libya.

Materials and methods: This study is a retrospective study performed of the medical records from pregnant women how were suspected to have *T. gondii* infection during the year 2020. These records were taken from three medical private laboratories at El-Beida city- Libya

Results: The obtained results of this study showed 18 positive samples out of 67 (26.86%) for *T. gondii* IgG with a p-Value= 0.000. Whereas 8 positive samples out of 67 (11.94%) for *T. gondii* IgM with a p-Value= 0.009.

Conclusion: seroprevalence of IgG of *T. gondii* in El-Beida city is 26.86% which is considered as an old infection, whereas the seroprevalence of IgM of *T. gondii* is 11.94% which is considered as a new infection. Advanced studies will be needed to clarify the reason for the high IgM seroprevalence in this city. Public educational programs should be taken in place to control the *T. gondii* infection.

Key words: *Toxoplasma gondii*, Toxo Seroprevalence, Toxo among pregnant women, Al-Baida-Libya.

How To Cite:

munay younus Al Abbar⁴. E. E. S. R. (2021). Seroprevalence of IgG and IgM of *Toxoplasma gondii* among pregnant women at El-Beida city-Libya. *International Journal of Medical Science in Clinical Research and Review*, 4(05), Page: 7-13. Retrieved from <https://ijmscrr.in/index.php/ijmscrr/article/view/165>



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

Introduction:

Toxoplasmosis is a disease caused by the protozoan *Toxoplasma gondii* which infects all

warm-blooded animals including birds and mammals⁽⁷⁾. However, toxoplasmosis is an important health problem worldwide⁽²⁰⁾, as about

30 % of human population worldwide is considered to be chronically infected with *T. gondii*⁽¹³⁾. Recently, Rouatbi et al. (2019)⁽¹⁸⁾ published a review study about the infection of *T. gondii* and toxoplasmosis in North Africa in humans and animals, the study was performed from five North African countries; Morocco, Algeria, Tunisia, Libya and Egypt. Starting from Morocco, by using Enzyme Linked Immunosorbent Assay (ELISA), the seroprevalence in pregnant women ranged between 36.7% and 62.1%, between 2007 and 2017. Whereas in Algeria serological investigation confirmed the presence of *T. gondii* antibodies in more than 30% to 53.2% in humans. As in Tunisia, the seroprevalence rates range from 39.3% in the southern regions to 47.7% in the northern regions using ELISA. In Libya, an infection rate of 38.5% in women was reported in

Tripoli by Gashout et al. (2016)⁽¹¹⁾. In addition, in Benghazi positive results were also detected in 47.7% of pregnant women, this study showed that the older age group had the highest infection rate (63.3%)⁽¹⁴⁾. In Misurata an infection rate of 26.7% was detected in the pregnant women⁽¹⁹⁾. Whereas an infection rate of 39.3% was observed in pregnant women in Alkhoms, using ELISA⁽¹⁰⁾. Finally, in Egypt the seroprevalence of *T. gondii* in humans is high, reaching 59.6%^(8,12,25). Thus, several biotic and abiotic factors play important roles in the transmission and the epidemiology of *T. gondii* infection. These factors determine host geographic distribution, density, and interactions⁽²¹⁾. Subsequently, Alghanaei and Abdulsalam (2019)⁽²⁾ reported significant differences from region to region in the prevalence of *T. gondii* in Libya as it is shown in table 1.

Table1: Prevalence of *T. gondii* in Libya⁽²⁾.

Region/ Year	Sample size	Population	Assay*	Seroprevalence (%)
Tripoli 1987	2000	Adult males	LAT	51.6
	300	Adult females		43.4
	1980	School children		43.7
Benghazi 1991	369	Pregnant women	IHA	47.4
Tripoli 2008	692	Women who suffered of spontaneous abortion	ELISA	IgM 17.6-IgG 45
Tripoli 2008	474	Non pregnant women	ELISA	IgG 18.14
Benghazi 2011	143	Pregnant women with previous adverse pregnancy outcome	ELISA	IgM 8.4- IgG 44.8
Tripoli 2014	300	Psychiatric patients	LAT	61.7
			ELISA	IgG 50.3
	300	Control volunteers	LAT	46.7
			ELISA	IgG 33
Benjawad 2015	280	Pregnant women	ELISA	IgM 3.57-IgG 37.13
	250	Non pregnant women	ELISA	IgM 3.60- IgG 37.2
Alkhoms 2015	361	Pregnant women	ELISA	IgG 39.3
Misurata 2015	300	Pregnant women	LAT	26.7
			ELISA	IgM 1.00- IgG 26.7

Sebha 2016	267	Pregnant women	ELISA	IgM 15.37- IgG 25.89
Sebha 2016	190	Pregnant women	ELISA	IgM 0.0- IgG 36.84
Tripoli 2016	140 26 9 2	Abortion women HIV- positive patients Leukemia and Lymphoma patients Infants with ocular infection	ELISA	38.5 88 66.6 50
Tripoli 2017	298 92 56 150	Children Suspected cryptogenic epilepsy Symptomatic epilepsy Non epileptic	ELISA	IgG 35.2 IgG 29.4 IgG 29
Msallata 2017	170	Abortion women	LAT ELISA	41 IgM 35- IgG 26
Benghazi 2018	43	Patients suspected of ocular toxoplasmosis	ELISA	IgM 00- IgG 55.8
Benghazi 2018	200 50	Type- 2 Diabetic patients Non-diabetic individual	ELISA	IgM 10.5- IgG 41.5- IgA 3.5 IgM 4.0- IgG 24- IgA 00
*Latex agglutination test (LAT), Indirect haem agglutination assay (IHA) and Enzyme-Linked Immunosorbent assay (ELISA)				

Indeed, the detection of *T. gondii* infection in human can be performed by several types of the diagnostic methods, ELISA is the most important one of these methods which is one of a variety of serological methods to detect different antibody classes or antigens^(7,16). As for the antibodies production against *T. gondii*, within one week after the infection IgM antibodies could be detected which will remain for several months or may for years. Therefore, detection of IgM alone will not be sufficient to establish an acute infection. IgA antibodies are produced earlier

than IgM, they considered to be a marker of acute infection, and may persist for several months. IgE may give a greater indication of current infection because it remain for a short period. Whereas the presence of IgG antibodies suggest an old infection, without provide any information about the timing of infection^(16,23). As there is no enough data about the prevalence of toxoplasmosis in El-Beida city – Libya, therefore this study was aimed to determine the *T. gondii* seroprevalence of IgG and IgM among pregnant women at El-Beida city in Libya.

Materials and methods:

This study is a retrospective study performed of the medical records from pregnant women how were suspected to have *T. gondii* infection during the year 2020. These records were taken from three medical private laboratories at El-Beida city- Libya; Taiba lab, El-Beida lab, and Al Rashid lab. All the results were obtained by ELISA using Elecsys-Cobas e analyser to detect Toxo IgG and Toxo IgM, the used reagents are made by ROCHE company. Individual age was also recorded. After data collection, comparison was made between the seroprevalence of *T. gondii* IgG and IgM.

Statistical analysis: The obtained results have been statistically analysed by using Minitab 16 and carried out by using Fisher's exact test, t-test, and One-way ANOVA using Tukey's Method. A probability p-value of ≤ 0.05 was considered as significant whenever appropriate by determining the confidence interval =95% and error interval =5%.

Results and discussion:

Distinctly, toxoplasmosis is one of the most important TORCH members, which includes, Toxoplasmosis, Other (syphilis, varicella-zoster, parvovirus B19), Rubella, Cytomegalovirus, and Herpes infections, are the most common infections associated with the medical problems

during the pregnancy pried⁽¹³⁾. Moreover, primary maternal *T.gondii* infection during pregnancy has been associated with spontaneous abortion^(1,4), as well it is frequently associated with its transmission to the fetus, which will be at risk^(17,22). Indeed, seroprevalence of *T. gondii* among pregnant women had been well studied and documented in deferent Libyan cities these studies showed significant differences from region to region in the prevalence of *T. gondii*⁽²⁾. On the other side, to detect serologically different *T. gondii* antibody classes, ELISA is most common used test^(1,7,16). Based on ELISA, data of this study is a retrospective which performed among pregnant women how were suspected to have *T. gondii* infection, the recorded data were sourced from three medical private laboratories at El-Beida city- Libya during the year 2020. The obtained results of this study showed 18 positive sample out of 67 (26.86%) for *T. gondii* IgG with a p-Value= 0.000. Where as 8 positive sample out of 67 (11.94%) for *T. gondii* IgM with a p-Value= 0.009. However, the seroprevalence of *T. gondii* IgG and IgM is significantly deferent p-Value = 0.024 as shown in table 2. Three samples out of 67 they were positive to both IgG and IgM (4.48%) with a p-Value= 0.844 as shown in table 2 and 3.

Table 2: Seroprevalence of *T. gondii* IgG and IgM in El-Beida city-Libya.

Ig Type	Total No. of samples	No. of positive samples (%)	p-value
IgG	67	18 (26.86%)	0.000
IgM	67	8 (11.94%)	0.009
p-value	--	0.024	--
Both IgG&IgM	67	3 (4.48%)	0.844

Similar results for Toxo IgG was obtained in Misurata-Libya, as the IgG positive result was detected in 26.7% among the pregnant women⁽¹⁹⁾. Instead of this similarity in IgG

prevalence, a totally deferent in the IgM prevalence, as the Toxo IgM was detected in 11.94% in this study, whereas only in 1% among the studied pregnant women in Misurata⁽¹⁹⁾.

However, these similarity and differential in the seroprevalence of Toxo IgG and IgM, from region to region inside Libya, are may attributed to several factors; contact with the livestock species, presence of cats in farms, drinking untreated water, advanced age, difference to the temperate climate, and cultural differences regarding hygienic and feeding habits^(5,10,23). In addition, such differences in *T. gondii* seroprevalence could

have possibly resulted from the differences in the sample size, condition of the tested women, and the diagnostic method used for the evaluation. Even though, still much effort will be needed to clarify the reason for the high IgM seroprevalence in El-Beida city. Back to this study results, table 3 shows the Seroprevalence of IgG and IgM for *T. gondii* based on the age group.

Table 3: Seroprevalence of *T. gondii* based on the age group.

Age group (year)	Total No. of samples out of 67 (%)	No. of IgG positive samples out of 18 (%)	No. of IgM positive samples out of 8 (%)	No. of IgG&IgM positive samples out of 3 (%)
18-30	36 (53.7%) A	3 (16.7%) A	5 (62.5%) A	3 (100%)
31-40	17 (25.4%) B	8 (44.4%) A	3 (37.5%) A&B	0 (0%)
41-50	14 (20.9%) B	7 (38.9%) A	0 (0%) B	0(0%)
p-value	*	*	*	--

*: Means that do not share a letter are significantly different

Importantly, the obtained results showed no correlation between transmission of the *T. gondii* infection and the age group, this result in an agreement with that results obtained from some Libyan studies^(3,24). Theoritically, older women are more likely to have been exposed to any one of the risk factors than younger women as a result of longer exposure time. Interestingly, the obtained results of this study showed 62.5% seroprevalence of Toxo IgM among the younger age group (18-30), which is significantly higher than the infection rates in the older age group (41-50). This result clearly explain that the younger age is most likely to be exposed to the new *T. gondii* infection, or it could be due to the

difference in the sample size presented within the age groups. In addition, the obtained results of this study revealed three positive samples with both immunoglobulins (IgG and IgM) within the younger age group. Usually, positive of Toxo IgG reflects a sign of past exposure to *T. gondii* and it does not require treatment⁽⁶⁾. In contrast, positive of Toxo IgM determines the acute stage of the infection, which may indicate a recent exposure to the infection. Consequently, IgM positive is the most serious form which requires treatment and is often regarded as acute stage of the toxoplasmosis⁽¹⁵⁾. In particular, IgM antibodies may be delayed or persist for a long period in the host, which result in either false-

positive or false-negative results⁽⁹⁾. Unfortunately, currently in Libya there are no specific national programs against toxoplasmosis. Therefore, there should be a local public educational programs for better understanding of the infection route of *T. gondii*, awareness on the risk factors, and an early diagnosis which may contribute to saving the life of the pregnant women and the unborn child. Finally, medical laboratories should record more personal information, such as; number of pregnancy times, number of abortion times, the job, and personal location to help researchers and the professionals

References:

1-Abdel-Raouff, M. and Elbasheir, M. M. (2014). Sero-prevalence of Toxoplasma gondii infection among pregnant women attending antenatal clinics in Khartoum and Omdurman Maternity Hospitals, Sudan. Journal of Coastal Life Medicine. 2(6): 496-499.

2-Alghanaei Rajaa A, Awatif M. Abdulsalam. Risk factors of toxoplasmosis in Libya: a brief review. JO PAS Vol.18 No. 4 2019.

3-AL-Ghariane, N. J. (2006). The prevalence of Toxoplasma gondii Antibodies in women from Benghazi, Libya. M Sc. Thesis, Garyounis University, Benghazi, Libya.

4-AL-Hindi, A. I. and Lubbad, A.H. (2009). Seroprevalence of Toxoplasma gondii among Palestinian aborted women in Gaza. Annals of Alquds medicine. 5:39-47.

5-Benkirane A, Jabli N, Rodolakis A. 1990. Fréquence d'avortement et séroprévalence des principales maladies infectieuses abortives ovines dans la région de Rabat (Maroc). Annales de Recherches Vétérinaires, 21(4), 267–273.

6-Casartelli-Alves, L.; Boechat, V.C.; Macedo-Couto, R.; Ferreira, L.C.; Nicolau, J.L.; Neves, L.B.; Millar, P.R.; Vicente, R.T.; Oliveira, R.V.C.; Muniz, A.G.; et al. Sensitivity and specificity of serological

for designing specific programs for controlling the infections.

Conclusion:

In This study, the seroprevalence of IgG of *T. gondii* in El-Beida city is 26.86% which considered as an old infection, whereas the seroprevalence of IgM of *T. gondii* is 11.94% which considered as a new infection. Advanced studies will be needed to clarify the reason for the high IgM seroprevalence in this city. Public educational programs should be taken in place to control the *T. gondii* infection.

tests, histopathology and immunohistochemistry for detection of Toxoplasma gondii infection in domestic chickens. Vet. Parasitol. 2014, 204, 346–351.

7-Dubey JP. 2010. Toxoplasmosis of animals and humans, 2nd edn. CRC Press Inc, Boca Raton, New York.

8-Elsheikha HM, Aboul-Dahab MAO, Abdel Maboud AI, El-Sherbini ET. 2009. Prevalence and risk factors of Toxoplasma gondii antibodies in asymptomatic Egyptian blood donors. Journal of the Egyptian Society of Parasitology, 39, 351–361.

9-Emelia, O.; Rahana, A.R.; Mohamad Firdaus, A.; Cheng, H.S.; Nursyairah, M.S.; Fatinah, A.S.; Azmawati, M.N.; Siti, N.A.; Aisah, M.Y. IgG avidity assay: A tool for excluding acute toxoplasmosis in prolonged IgM titer sera from pregnant women. Trop. Biomed. 2014, 31, 633–640.

10-Gamal MAB, Jaroud RB. 2015. Seroprevalence study of IgG antibodies to Toxoplasma, and risk factors for Toxoplasma infestation among pregnant women in Alkhoms state, Libya. Lebda Medical Journal, 1, 15–19.

11-Gashout A, Amro A, Erhuma M, Al-Dwibe H, Elmaihub E, Babba H, Nattah N, Abudher A. 2016. Molecular diagnosis of Toxoplasma gondii

- infection in Libya. *BMC Infectious Diseases*, 16, 157.
- 12-Ibrahim BB, Salama MM, Gawish NI, Haridy FM. 1997. Serological and histopathological studies on *Toxoplasma gondii* among the workers and the slaughtered animals in Tanta Abattoir, Gharbia Governorate. *Journal of the Egyptian Society of Parasitology*, 27, 273–278.
- 13-Johnson P, Barnes R, Hart C, Francis W: Determinants of immunological responsiveness in recurrent spontaneous abortion. *Transpl*, 38(3):280-4, 1994.
- 14-Kassem HH, Morsy TA. 1991. The prevalence of anti-*Toxoplasma* antibodies among pregnant women in Benghazi, (S.P.L.A.J.) Libya. *Journal of the Egyptian Society of Parasitology*, 21, 69–74.
- 15-Kotresha, D.; Poonam, D.; Muhammad Aidil, Y.; Saadatnia, G.; Nurulhasanah, O. Recombinant proteins from new constructs of SAG1 and GRA7 sequences and their usefulness to detect acute toxoplasmosis. *Trop. Biomed.* **2012**, 29, 129–137.
- 16-Liu Quan , Ze-Dong Wang, Si-Yang Huang and Xing-Quan Zhu. Diagnosis of toxoplasmosis and typing of *Toxoplasma gondii*. *Parasites & Vectors* (2015) 8:292.
- 17-Nimri L, Pelloux H, Elkhatib H: Detection of *T. gondii* DNA and specific antibodies in high-risk pregnant women. *Am J Trop Med Hyg*, 71(6): 831-5, 2004.
- 18-Rouatbi Mariem, Safa Amairia, Yosra Amdouni, Mohamed Anis Boussaadoun, Ouarda Ayadi, Amira Adel Taha Al-Hosary, Mourad Rekik, Rym Ben Abdallah, Karim Aoun, Mohamed Aziz Darghouth, Barbara Wieland, and Mohamed Gharbi, *Toxoplasma gondii* infection and toxoplasmosis in North Africa: a review. *Parasite, EDP Sciences*, 2019, 26, pp.6.
- 19-Sariti, Salem. R., Al-Gazal, Mohammed. A. and Elsalhi, Randa. M. (2015). Seroprevalence of *Toxoplasma gondii* among pregnant women in Misurata, Libya. *Second Symposium on Theories and Applications of Basic and Biosciences*, 5th September, 2015, Misurata, Libya.
- 20-Sukthana Y. 2006. Toxoplasmosis: beyond animals to humans. *Trends in Parasitology*, 22, 137–142.
- 21-Tenter AM, Heckeroth AR, Weiss LM. 2000. *Toxoplasma gondii*: from animals to humans. *International Journal of Parasitology*, 30, 1217–1258.
- 22-Villena I, Chemla C, Quereux C, Dupouy D, Leroux B, Foudrinier F: Prenatal diagnosis of congenital toxoplasmosis transmitted by an immuno-competent woman infected before conception. *Reims Toxoplasmosis Group. Prenat Diagn*, 18(10):1079- 81, 1998.
- 23-Wana Mohammed Nasiru, Mohamad Aris Mohd Moklas, Malaika Watanabe, Norshariza Nordin, Ngah Zasmay Unyah, Sharif Alhassan Abdullahi, Ashraf Ahmad Issa Alapid, Tijjani Mustapha, Rusliza Basir and Roslaini Abd. Majid. A Review on the Prevalence of *Toxoplasma gondii* in Humans and Animals Reported in Malaysia from 2008–2018. *Int. J. Environ. Res. Public Health* 2020, 17, 4809
- 24-Younis, E. Z. and Elamami, A.H.(2018). Anti-*Toxoplasma gondii* IgG, IgM, and IgA among Type-2 Diabetic Patients in Benghazi Libya: A Comparison Study. *Journal of Immunology and Microbiology*. 2(2):1-5.
- 25-Youssef ME. 1993. Profile of toxoplasmosis in two different localities in Dakahlia Governorate. *Journal of the Egyptian Society of Parasitology*, 23, 423–430.