



Original Article

Seroprevalence of *Toxoplasma gondii* Among Pregnant Sudanese Ladies

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Abstract

Introduction: The present study aimed to find the seroprevalence of toxoplasmosis and assess its associated risk factors among pregnant women.

Methods: This retrospective hospital-based study was carried out in the period between January 2009 and December 2010 in Eldammar, River Nile State, Sudan. Chi-square was used for trend analysis, and *P* value was used to declare the statistical significance between the variables.

Results: A total of 383 pregnant women (age range: 16–45 years) visiting Eldammar teaching hospital and other health centers for antenatal care were selected. Using latex agglutination test (LAT), 74.7% (285/383) were positive for toxoplasmosis. ELISA (enzyme-linked immunosorbent assay) was used for IgM & IgG confirmatory, and the results showed that 26% (74/285) and 34.7% (99/285) were positive for toxoplasmosis. There was a significant correlation between serological evidence of toxoplasmosis and low education level, eating undercooked meat, and drinking raw milk (*P*<0.05).

Conclusion: There was a high prevalence of toxoplasmosis among pregnant women of the studied population. A positive correlation was reported between toxoplasmosis and low education level, eating undercooked meat, and drinking raw milk.

Keywords: Toxoplasmosis, ELISA, Eldammar, Sudan

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Introduction

Toxoplasma gondii is an obligate intracellular protozoan parasite that contaminates all warm-blooded creatures. *T. gondii* infection is possibly the most well-known human infection. The situation assessed that around 33% of the world population has been exposed to *T. gondii* (1). Humans are affected by eating crude or half-cooked meat contaminated with sporulated oocysts, or by exposure to infested environment (2). Other rare reasons for infection include vertical transmission to the embryo, and via organ transfer from infected donors (3).

Moms who obtained the parasite at a far off time prior to gestation has a restricted danger of inborn disease. (4). The seriousness level of inherent toxoplasmosis is conversely identified with gestational age at the hour of contamination. Throughout the primary trimester, the

frequency of transmission is low yet the contamination will bring about serious inherent toxoplasmosis. Late disease is described by high transmission, yet less fetal bleakness (5). A wide scope of antagonistic pregnancy results have been portrayed including unconstrained premature delivery or stillbirth. Inherent toxoplasmosis in a newborn child next vertical transmission can prompt a broad scope of bleakness and death (6,7).

Extreme baby blues and myonecrosis can result from *T. gondii* and *Clostridium perfringens* (8). There is a wide uniqueness in the frequency of intrinsic toxoplasmosis in the created nations, ranging from 1 to 10 in 10000 live births (9). Higher rates have been reported in the United Kingdom (3.4/10000) (10) and Denmark (4/10000) (11). Serological testing for *Toxoplasma* antibodies is broadly used (12,13).



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In Arab and African nations, information on *T. gondii* during pregnancy is sparse. Additionally, most investigations are provincial. Pregnant women are not regularly examined for *T. gondii* during pregnancy, and development does not exist. Thus, the present study aimed to find the seroprevalence of toxoplasmosis and assess its associated risk factors among pregnant women (14).

Materials and Methods

Study Design

This retrospective hospital-based study was carried out in the period between January 2009 and December 2010 in Eldammar (300 kilometers north of Khartoum), River Nile State, Sudan.

Study Population

All pregnant women visiting Eldammar hospital and other health centers during the study period were asked to answer a structured questionnaire consisting of socio-demographic data, as well as risk factors of toxoplasmosis.

Study Variables

The dependent variable of this study was toxoplasmosis test results, because the independent variables were education level, eating undercooked meat, and drinking raw milk.

Sample Size and Data Collection

In this study, 5 mL of blood samples were taken from all subjects. The sera were separated in free anticoagulant plain containers and the serological evidence of toxoplasmosis were tested using latex agglutination test (LAT) SPINREACT. SA/S.A.U Ctra. Santa Coloma, Spain). Any positive result by LAT confirmed by ELISA (enzyme-linked immunosorbent assay).

Data Analysis

The Statistical Package for Social Sciences version 20 (SPSS Inc., Chicago, IL, USA) was used for data analysis of the demographic characteristics. Laboratory findings of toxoplasmosis test and demographic data were analyzed by simple descriptive statistics. Chi-square test was used to compare every two variables. A P value less than 0.05 was considered as statistically significant.

Results

A total of 383 pregnant women from different localities in Eldammar enrolled in the study. The ages of the participant ranged from 16 to 45 years. 74.4% (285/383) were positive for toxoplasmosis by latex agglutination test, and 26 % (74/285), 34.7 % (99/285) were positive for toxoplasmosis by ELISA IgM & IgG. (Table 1).

Study showed statistically significant correlation between toxoplasmosis and (low education level, eating undercooked meat, and drinking raw milk with P value (P < 0.05). Table 2 and 3

Discussion

Seroprevalence of toxoplasmosis in the present study was 74.4% by LAT and 26%, 34.7% by ELISA IgM and IgG respectively which is higher than the study implemented in Atbara River Nile State-Sudan (33.6%) by LAT (13), this due to small sample of the compared study or due difference of lifestyle between two study areas, or due to different accuracy of LAT reagent used.

The study revealed there was a statistically significant correlation between toxoplasmosis and low education level (P=0.01, P=0.04), eating undercooked meat (P=0.00,

Table 1. The LAT and ELISA IgM & IgG Results

Test	Positive	Negative	Total
LAT	285 (74.4%)	98 (25.6%)	383 (100%)
ELISA IgM	74 (26%)	211 (74%)	285 (100%)
ELISA IgG	99 (34.7%)	186 (65.3%)	285 (100%)

Table 2. The Correlation between Toxoplasmosis and Education Level, Eating Undercooked Meat, and Drinking Raw Milk

Parameter		LAT Screening		P Value
		Positive	Negative	
Education level	Primary school and below	213	58	0.001
	Secondary school and above	72	40	
Eating undercooked meat	Yes	226	56	0.000
	No	59	42	
Drinking raw milk	Yes	35	5	0.030
	No	250	93	

Table 3. The Correlation between Toxoplasmosis and Education Level, Eating Undercooked Meat, and Drinking Raw Milk

Parameter		ELISA IgM		P value	ELISA IgG		P value
		Positive	Negative		Positive	Negative	
Education level	Primary school and below	118	153	0.06	138	133	0.04
	Secondary school and above	54	58		59	53	
Eating undercooked meat	Yes	58	47	0.04	68	37	0.05
	No	114	164		129	149	
Drinking raw milk	Yes	19	21	0.01	24	16	0.03
	No	153	190		173	170	

$P=0.05$, $P=0.04$), and drinking raw milk ($P=0.03$, $P=0.03$, $P=0.01$). How revealed the association between toxoplasmosis and low education level. While (14) reported a significant correlation between toxoplasmosis and drinking raw milk. Regarding the association between raw and undercooked meat and toxoplasmosis (12).

Our study suggests high education level was found protective factor to diminish the risk of transmission in high-risk populations. Molecular modalities like PCR as well as ELISA are better than Latex Agglutination Test.

Authors' Contributions

The authors equally participated in designing the study and writing the manuscript. All authors read and approved the final version of the manuscript.

Conflict of Interests

The authors declare no conflict of interests.

Ethical Approval

The ethical approval was taken from the state ministry of health. An informed consent was taken from all participants before enrolling them in the study.

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References

1. Tenter AM, Heckerth AR, Weiss LM. *Toxoplasma gondii*: from animals to humans. *Int J Parasitol*. 2000;30(12-13):1217-1258. doi:10.1016/s0020-7519(00)00124-7
2. Hill D, Dubey JP. *Toxoplasma gondii*: transmission, diagnosis and prevention. *Clin Microbiol Infect*. 2002;8(10):634-640. doi:10.1046/j.1469-0691.2002.00485.x
3. Montoya JG, Liesenfeld O. *Toxoplasmosis*. *Lancet*. 2004;363(9425):1965-1976. doi:10.1016/s0140-6736(04)16412-x
4. Cook AJ, Gilbert RE, Buffolano W, et al. Sources of *Toxoplasma* infection in pregnant women: European multicentre casecontrol study. *European Research Network on Congenital Toxoplasmosis*. *BMJ*. 2000;321(7254):142-147. doi:10.1136/bmj.321.7254.142
5. Martin S. Congenital toxoplasmosis. *Neonatal Netw*. 2001;20(4):23-30. doi:10.1891/0730-0832.20.4.23
6. Jones JL, Kruszon-Moran D, Wilson M, McQuillan G, Navin T, McAuley JB. *Toxoplasma gondii* infection in the United States: seroprevalence and risk factors. *Am J Epidemiol*. 2001;154(4):357-365. doi:10.1093/aje/154.4.357
7. Alsammani MA, Ahmed SR, Alsheeha MA, Saadia Z, Khairi SA. Co-infection with *Toxoplasma gondii* and *Clostridium perfringens* in a postpartum woman with uterine gas gangrene: a case report. *J Obstet Gynaecol Res*. 2012;38(7):1024-1027. doi:10.1111/j.1447-0756.2011.01817.x
8. Guerina NG. Congenital infection with *Toxoplasma gondii*. *Pediatr Ann*. 1994;23(3):138-142, 147-151. doi:10.3928/0090-4481-19940301-07
9. Gilbert R, Tan HK, Cliffe S, Guy E, Stanford M. Symptomatic *Toxoplasma* infection due to congenital and postnatally acquired infection. *Arch Dis Child*. 2006;91(6):495-498. doi:10.1136/adc.2005.088385
10. Lebech M, Andersen O, Christensen NC, et al. Feasibility of neonatal screening for *Toxoplasma* infection in the absence of prenatal treatment. Danish Congenital Toxoplasmosis Study Group. *Lancet*. 1999; 353(9167):1834-1837. doi:10.1016/s0140-6736(98)11281-3
11. Remington JS, McLeod R, Thulliez P, Desmonts G. *Toxoplasmosis*. In: Remington JS, Klein JO, eds. *Infectious Diseases of the Fetus and Newborn Infant*. Philadelphia: WB Saunders; 2001:205-346.
12. Alsammani MA. Sero-epidemiology and risk factors for *Toxoplasma gondii* among pregnant women in Arab and African countries. *J Parasit Dis*. 2016;40(3):569-579. doi:10.1007/s12639-014-0558-8
13. Taha RKM, Hamad MNM, & Taha KM, Hamad AEN. Seroprevalence of toxoplasmosis between aborted ladies in Atbara district, Sudan. *MOJ Womens Health*. 2019;8(1):86-87. doi:10.15406/mojwh.2019.08.00217
14. Pinto-Ferreira F, Caldart ET, Pasquali AKS, Mitsuka-Breganó R, Freire RL, Navarro IT. Patterns of transmission and sources of infection in outbreaks of human toxoplasmosis. *Emerg Infect Dis*. 2019;25(12):2177-2182. doi:10.3201/eid2512.18156.

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