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Original Article

Seroprevalence and Associated Risk Factors of *Toxoplasma gondii* in Pregnant Women Attending in Northwest Ethiopia

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Abstract

Background: Toxoplasmosis is a major public health problem among immunocompromised individuals. This study aimed to determine the seroprevalence and associated risk factors of *Toxoplasma gondii* infection among pregnant women with and out HIV infections.

Methods: This cross sectional study was conducted among consecutive 385 pregnant women attended Antenatal Clinic from May 2010 to October 2011 at the Gondar University Teaching Hospital, Northwest Ethiopia. Venous blood was collected from each pregnant woman for testing HIV-1/2 and anti- *Toxoplasma* antibodies using rapid test kits. Data were entered and analyzed using SPSS version 20 statistical package.

Results: The overall magnitude of *T. gondii* and HIV was 88.6% (341/385) and 11.2% (43/385), respectively. The seroprevalence of *T. gondii* was not different among HIV infected and non-infected pregnant women (88.4%, 38/ 43 vs. 88.6%, 303/342). Keeping cats in house showed statistically significant association with seropositivity of toxoplasmosis ($P<0.05$).

Conclusion: Irrespective of HIV infection, high rate of *T. gondii* was detected among pregnant women. These high prevalences indicate the need for an intensified public health awareness to reduce both infections.

Introduction

Toxoplasmosis is a zoonotic parasitic disease prevalent all over the world and its causal agent is an intracellular protozoon called *Toxoplasma gondii*. The protozoa was first discovered by Nicolle and Manceaux (1908) as *Ctenodactylus gundi* and later named as *T. gondii* (1909) (1). Up to one third of the world's population is infected by *T. gondii* (2). Most infections among humans occur by eating undercooked or raw meat containing tissue cysts or by exposure to oocysts through ingestion of contaminated foods and drinks with cat faeces (3). It is also transmitted transplacentally (4).

In the vast majority of immunocompetent human host, *T. gondii* ensue a latent infection characterized by the persistence of the organism primarily in brain, skeletal muscle, and heart tissues without causing clinical symptoms (5). However, in chronically infected individuals with impaired cell-mediated immunity symptomatic disease more likely occurs as a result of reactivation of latent infection (6, 7). In this group of immunodeficient people, toxoplasmosis causes a large range of manifestations such as, fever, lympaphadenitis and fatal encephalitis (8). Moreover, toxoplasmosis has a great public health importance in pregnant women as it can lead to transplacental transmission and involvement of the fetus with pathological effects which even results in uterine death (9, 10). When HIV infected pregnant women are exposed to *T. gondii* its severity will be doubled both in woman and the fetus (9, 10). Accordingly screening of pregnant women for *T. gondii* infection has been practiced in developed nations. However, serological screening of pregnant women for *T. gondii* antibodies is not part of routine clinical practices in sub Saharan countries including Ethiopia, in spite of high prevalence of the infection in this country (8, 11-16). Data on seroprevalence of *T. gondii* during pregnancy with HIV co-infection is lacking.

This study aimed to determine the magnitude of anti- *T. gondii* antibody reactivity and associated risk factors of toxoplasmosis among HIV positive and HIV negative pregnant women in Northwest of Ethiopia.

Materials and Methods

Study design, area and period

This cross sectional study was conducted among consecutive pregnant women attending antenatal clinic (ANC) from May 2010 to October 2011 at the Gondar University Teaching Hospital, Northwest Ethiopia.

Data collection

Structured, pre-tested questionnaire was used to collect socio-demographic characteristics and risk factors associated with *T. gondii* infection.

Five milliliter (ml) of blood was collected from each pregnant woman and serum was separated. Sera were tested in duplicate for anti-toxoplasma antibody using the rapid latex agglutination test kit (BioChcek, Inc, CA, Spain) following manufacturer's instructions. The kit had with sensitivity and specificity of 92% and 95%, respectively. Positive and negative control tests were done for each batch of test run to ensure kits are working properly and technical procedures are carried out correctly. The serum was also tested for the presence of HIV-1/2 antibodies using rapid HIV diagnostic kit following manufacturer's instructions. Results were interpreted following the current algorithm of Ethiopia adopted from WHO for screening of HIV-1/2 antibodies. Briefly, the sera were tested using KHB HIV-1/2 (Shangai kehua Bio-engineering CO-Ltd, Shangai, China), when the sera were non-reactive it was reported as negative. When the serum was reactive, it was tested for the second time using STAT PAK (Chembio HIV1/2, Medford, New york, USA). If the serum was reactive for KHB HIV-1/2 it was reported as positive. If not a tiebreaker, Uni-Gold™ Recombigen® HIV (Trinity Biotech PLC, Bray, Ireland), was used

as a third and final test to determine the sero-status of the study participants.

Data analysis

The data were entered and analyzed using SPSS version 20 statistical package. Association between independent variables and sero-positivity was analyzed by bivariate and multivariate logistic regression. The strength of association was calculated using odds ratio at 95% confidence interval (CI). *P*-values less than 0.05 were considered as statistically significant.

Ethical clearance

Ethical clearance was obtained from University of Gondar Research and Community Service Core Process Office. Informed written consent was also obtained from each pregnant woman prior to involvement in the study.

Results

Three hundred and eighty five pregnant women who were attending ANC of the Gondar University Teaching Hospital were participated in the study. The majority of the study participants (81.6%) were aged between 20-30 years. Almost all, 383 (99.4%) had no any information about the disease toxoplasmosis and its transmission ways. Other sociodemographic characteristics of the study participants are presented in Table 1.

Among the 385 study participants, 43 (11.2%) were HIV positive, of whom 38 (88.4%) were also positive for toxoplasmosis (Table 2). Of the 385 pregnant women tested, 341(88.6%) were positive for anti-antibodies of anti-*T. gondii* IgG antibodies.

Pregnant women who kept cats in house had 5 times more risk of toxoplasmosis than those did not (P=0.00; AOR = 5.01 95% CI [1.50 - 14.11] (Table 2). Pregnant women who were in their second or third trimester were almost three times risk of *T. gondii* infection than those who were on the first trimester (P<0.05 for all) (Table 2). However, there was no statistically significant association between seropositivity of *T. gondii* infection and sero-status of HIV, educational status, age, antiretroviral therapy (ART), residence, religion or occupation and others. Having an experience of stillbirth also didn't show any statistically significant association with the presence of anti-*T. gondii* antibodies (Table 2).

Discussion

The prevalence of *T. gondii* infection among pregnant women in this study was high (88.6%) irrespective of HIV infection. The prevalence of *T. gondii* in this study is inconsistent with previous reports from different countries such as Italy (23.6%) (17), Sweden (ranged 14% to 25.7%) (18), where sero-prevalence of *T. gondii* is low. Low prevalence of *Toxoplasma* infection during pregnancy was also reported from study conducted in Korean and Sudanese pregnant women of 0.8% and 34.1%, respectively (19, 20). These differences in the prevalence show the epidemiological difference of toxoplasmosis in different countries. The 88.6% of sero-positivity of *T. gondii* among pregnant women were comparable to the previous studies conducted among pregnant women in different parts of Ethiopia, Nazaret (60%)(21), Jimma (83.6%) (14), Debrezeit, and Ambo (81.4%) (12). These finding shows *T. gondii* infection *is* not decreasing among pregnant women, this might be due to less emphasis to this infection and inadequate monitoring and evaluation health system. The low level of awareness about its transmission might also contribute to the high prevalence of *T. gondii* infection.

Among the risk factors assessed, keeping cats in house has been found to have statistically significant association with *T. gondii* infections.

Table 1: Characteristics and sero-prevalence of *T. gondii* among pregnant women attending ANC at Gondar University Teaching Hospital, Ethiopia May 2010 to October 2011

Characteristics	*T. gondii* IgG antibody		Total	*P*-value	COR (95% CI)	*P*-value	AOR (95% CI)
	Positive No. (%)	Negative No. (%)					
Age (yr)							
≤ 30	293 (87.9)	40 (12.0)	333	0.36	1.00	0.37	1.00
>30	48 (92.3)	4 (7.7)	52		1.64 (0.53-5.66)		2.09 (0.41 – 10.77)
Education status							
Illiterate	113 (88.3)	15 (11.7)	128	0.96	0.96 (0.47 – 1.96]	0.86	1.08 (0.46 – 2.49)
Literate	228 (88.7)	29 (11.3)	257		1.00		1.00
Residence							
Urban	243 (88.0)	33 (12.0)	276	0.57	1.00	0.55	0.76 (0.32 – 1.84)
Rural	98 (89.9)	11 (10.1)	109		1.21 (0.56 – 2.66)		
Religion							
Christian	311 (88.9)	39 (11.1)	350	0.58	1.33 (0.43 – 3.87)	0.61	0.76 (0.26 – 2.21)
Muslim	30 (85.7)	5 (14.3)	35		1.00		
Occupation							
Housewife	243(88.7)	31(11.3)	274	0.95	1.04 (0.49 – 2.17)	0.78	0.90 (0.40 – 2.00)
Non house wife	98 (88.3)	13 (11.7)	111		1.00		1.00
Trimester							
First	14 (70.0)	6 (30.0)	20		1.00		1.00
Second	228 (89.8)	26 (10.2)	254	0.01	3.76 (1.17 - 11.69)	0.01	2.51 (0.07 – 2.64)
Third	99 (89.2)	12 (10.8)	111	0.03	3.54 (0.99 - 12.43)	0.04	2.53 (0.07 – 2.92)
Still birth							
Yes	23 (88.5)	3 (11.5)	26	1.00	0.99 (0.27 - 4.33)	0.50	1.95 (0.28 – 13.03)
No	318 (88.6)	41 (11.4)	359		1.00		1.00
Total	341(88.6)	44(11.4)	385				

COR- Crude Odds Ratio, AOR- Adujusted Odd Ratio, CI-Confidence Interval

Table 2: Toxoplasmosis and associated risk factors among pregnant women attending ANC of the Gondar University Teaching Hospital, Northwest Ethiopia

Risk factors	*T. gondii* IgG antibody		Total No. (%)	*P*-value	COR (95% CI)	*P*-value	COR (95% CI)
	Positive No. (%)	Negative No. (%)					
Type of meat							
Goat	13 (75.5)	4 (23.5)	17 (4.4)	0.10	1.00		1.00
Sheep	42 (85.7)	7 (14.3)	49 (12.7)	0.45	1.85 [0.38 – 8.74]	0.13	16.64 (0.42 – 650.97)
Ox/cow	286 (89.7)	33 (10.3)	319 (82.9)		2.67 [0.69 - 9.51]	0.32	4.60 (0.228 – 93.07)
Eating raw meat							
Yes	9 (81.8)	2 (18.2)	11 (2.9)	0.36	0.57 [0.11 – 3.95]	1.00	0.00 (0.00 – 0.02)
No	332 (88.8)	42 (11.2)	374 (97.1)		1.00		1.00
Source of drinking water							
Pipe water	298 (88.7)	38 (11.3)	336 (87.3)	0.96	1.00	1.00	1.00
River /Well	43 (87.8)	6 (12.2)	49 (12.7)		0.91 [0.34 – 2.56]		1.00 (0.00 -2.87)
Boil water for drinking							
Yes	4 (100)	0 (0)	4 (1.0)	1.00	1.00	1.00	1.00
No	337 (88.5)	44 (11.5)	381 (99.0)		0.00 [0.00 – 12.19]		0.98 (0.00 - 1.21)
Keep dogs in house							
Yes	109 (91.6)	10 (8.4)	119 (30.9)	0.68	0.84 [0.44 – 1.61]	0.99	4.26 (0.00 - 5.61)
No	232 (87.2)	34 (12.8)	266 (69.1)		1.00		1.00
Keep cats in house							
Yes	123 (96.9)	4 (3.1)	127 (33.0)	0.00	5.64 [1.87 – 19.04]	0.00	5.01 (1.50 - 14.11)
No	218 (84.5)	40 (15.5)	258 (67.0)		1.00		
Type of milk							
Pasteurized/ Not at all	62 (83.8)	12 (16.2)	74 (19.2)	0.21	1.00	1.00	1.00
Unpasteurized	279 (89.7)	32 (10.3)	311 (80.8)		1.69 [0.77 – 3.64]		1.06 (0.51 – 2.33)
HIV							
Reactive	38 (88.4)	5 (11.6)	43 (11.2)	1.00	0.98 [0.34 – 3.01]	0.89	0.99 (0.44 – 2.89)
Non reactive	303 (88.6)	39 (11.4)	342 (88.8)		1.00		1.00
Total	341(88.6)	44(11.4)	385(100)				

COR- Crude Odds Ratio, AOR- Adujusted Odd Ratio, CI-Confidence Interval

This finding is similar with study conducted in Czech Republic**,** where cats in the household to be a significant risk factor (21, 22). This study also revealed that, about 88.6 % of HIV patients were sero-positive for *T. gondii* infection. However, seroprevalence of *Toxoplasma* ranged 4-90% were reported from different studies conducted in Europe, Latin America and Africa (23-31). In Asia, the seroprevalence of toxoplasmosis varies from 10-50% (29-32). The present finding with high prevalence of *Toxoplasma* antibodies suggests the need of measuring anti-*T. gondii* antibodies as a screening test in all HIV/AIDS patients to reduce the risk of *Toxoplasma* complications including encephalitis is needed in Ethiopia.

The demonstration that experience of stillbirth showed no significant association with toxoplasmosis among the pregnant women is in agreement with the report of Jamshidi Makiani et al., (33) and Hajsoleimani et al. (34) from Iran, and these findings substantiated earlier reports that stillbirth is not common in pregnant women who are with toxoplasmosis (33, 34).

Furthermore, pregnant women who were in their second/ third trimester had almost three times risk of *T. gondii* infection than those who were on the first trimester. This result is inconsistent with a previous study (33). It seems that the difference comes from the level of prenatal cares between the two countries. We guess that attending of the Ethiopian pregnant women to antenatal clinics in the first trimester is less than the second and third trimesters, which could be a cause for low frequency of the subjects in the first trimester in our study. Furthermore, it is possible that the women attending to the clinics in the first trimester are in higher socioeconomic situation as compared to those attended in the clinic in the 2nd and 3rd trimesters, thus they are at lower risk of soil and meat transmitted infections. However, further comparative follow-up study is needed to get strong evidence on this issue.

Conclusion

The seroprevalence of *T. gondii* is high in the study area. Keeping cats was the possible risk factors for toxoplasmosis. Almost none of the pregnant women know about the disease toxoplasmosis and its transmission ways. Therefore, health education should be given for the pregnant women about toxoplasmosis and further researches are recommended to see its transmission dynamics and effect on newborns.

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