



## Brief report

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# Seroprevalence of *Toxoplasma gondii* infection in pregnant women attending antenatal care in southern Ethiopia

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## ABSTRACT

**Objectives.** The aim of the study was to assess the prevalence and possible risk factors of *Toxoplasma gondii* (toxoplasmosis) infection in pregnant women attending antenatal care at Gambo General Rural Hospital, southern Ethiopia.

**Methods.** Hospital-based, prospective cross-sectional study. We collected 401 serum samples from September 1 to October 30, 2015, along with sociodemographic data and data on potential risk factors, using a simple random sampling technique.

**Results.** The overall seroprevalence of *T. gondii* in pregnant women (mean age 23.1 years) was 23.9% (95% confidence interval [CI] 20.0, 28.3). We did not find any significant risk factors associated with seropositivity in relation with participants' level of education; occupation; contact with cats; consumption of raw or uncooked meat, vegetables, or milk; or type of flooring (soil versus cement) at home. The women who were aware of the risk of toxoplasma infection on the fetus had fewer *T. gondii* antibodies. Drinking unsafe water was associated with a higher risk of toxoplasmosis ( $p = 0.08$ ).

**Conclusion.** The seroprevalence of toxoplasmosis among pregnant women was relatively lower.

**Key words:** Seroprevalence, *Toxoplasma gondii*, Maternal health, Ethiopia

## Seroprevalencia de *Toxoplasma gondii* en mujeres embarazadas que acuden a la atención prenatal en el sureste de Etiopía

## RESUMEN

**Objetivos.** Evaluar la prevalencia y los posibles factores de riesgo de la infección por *Toxoplasma gondii* (toxoplasmosis) en mujeres embarazadas que reciben atención prenatal en el Hospital Rural General de Gambo, en el sureste de Etiopía.

**Métodos.** Estudio prospectivo transversal de base hospitalaria. Se tomaron 401 muestras de suero desde el 1 de septiembre hasta el 30 de octubre de 2015, junto con a datos sociodemográficos y factores de riesgo potenciales, utilizando una técnica de muestreo aleatorio simple.

**Resultados.** La seroprevalencia general de *T. gondii* en mujeres embarazadas (edad media de 23,1 años) fue del 23,9% (intervalo de confianza [IC] del 95%: 20,0; 28,3). No encontramos ningún factor de riesgo significativo asociado con la seropositividad en relación con el nivel de educación de los participantes; ocupación; contacto con gatos; consumo de carne, verduras o leche crudas o sin cocinar; o tipo de piso de la casa(suelo versus cemento) en casa. Las mujeres que conocían el riesgo de tener infección por toxoplasma tenían menos anticuerpos contra *T. gondii*. Beber agua no segura se asoció con un mayor riesgo de toxoplasmosis ( $p = 0,08$ ).

**Conclusión.** La seroprevalencia de toxoplasmosis entre las mujeres embarazadas fue relativamente baja.

**Palabras clave:** Seroprevalencia, *Toxoplasma gondii*, Salud Materno-infantil, Etiopía

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## INTRODUCTION

Toxoplasmosis is one of the primary foodborne parasitic diseases [1]. It affects one-third of the world's population, with prevalence rates in low- and middle-income countries ranging from 30% to 60% [2]. Toxoplasmosis had a burden of approximately 1.68 million (95% uncertainty interval [UI] 1.24, 2.45) disability-adjusted life years (DALYs) [1]. Primary infections with *Toxoplasma gondii* acquired during pregnancy are usually asymptomatic for the mother but can lead to serious neonatal complications for the newborn [3], including miscarriage, hydrocephalus, cerebral calcification, and chorioretinitis [4].

Serological screening of pregnant women or *T. gondii*-specific antibodies is not practiced in antenatal care in Ethiopia, but there are several studies providing data about its prevalence [5–11]. This study aimed to assess the seroprevalence and associated risk factors of *T. gondii* infection in a rural area of southern Ethiopia.

## MATERIAL AND METHODS

The study population was pregnant women attending Gambo Rural Hospital (GRH), a 150-bed rural general hospital located in the West-Arsi region, 250 km south of Addis Ababa. The GRH is a private mission hospital. Due to an inadequate transportation network, the coverage area of the GRH is restricted to approximately 75,000 inhabitants, most of whom live in a rural setting and work in agriculture and farming.

We performed a cross-sectional study in consecutive pregnant women attending a mother and child healthcare clinic in GRH from September 1 to October 30, 2015. Blood samples were collected on Whatman filter paper, stored at 2°–8° C, and subsequently transported to the Microbiology Laboratory of Hospital General Universitario de Alicante, Spain. We performed an elution for serological determinations in a volume of 300 µL, as described elsewhere [6]. Investigators collected demographic information from participants at the same time of blood drawing. A commercial enzyme immunoassay (EIA) was used to detect immunoglobulin G (IgG) type antibodies for *T. gondii* (Demeditec Diagnostics GmbH, Germany) according to the manufacturer's instructions.

Participant data were anonymized, and the study received ethical approval from the local Research and Publication Committee of the GRH and the Health Unit and Ethical Review Committee of the Ethiopian Catholic Secretariat (GH/MSMHF/723).

Data were collected and entered into Excel software. The data were then cleaned and imported into SPSS statistical software, version 22 (IBM, Chicago, IL, USA) for analysis. We used the Student's t test to evaluate continuous data and the Chi-square test to analyze categorical variables. We estimated prevalence with 95% confidence intervals (CI) using the Wilson procedure. We expressed the measure of association as an odds ratio (OR) with 95% CI. P values less than 0.05 were considered statistically significant.

## RESULTS

We initially included 408 participants in the study, but seven were excluded due to an error in numbering or blood droplets on the filter paper. The mean age of the 401 analyzed participants was 23.1 years (standard deviation [SD] 4.9). Three patients had HIV infection (0.8%). About one in every 10 pregnant women had knowledge of toxoplasmosis infection and its risk to the fetus.

Participant characteristics, including sociodemographic data and history of exposure to known risk factors for *T. gondii* infection, are presented in table 1. The overall seroprevalence of *T. gondii* in our sample was 23.9% (95% CI 20.0, 28.3). We did not find any significant factors associated with seropositivity related to participants' level of education; occupation; contact with cats; consumption of raw or uncooked meat, vegetables or milk; or type of flooring (soil versus cement) in the home. The pregnant women who know the risk of toxoplasma infection on fetus had fewer *T. gondii* antibodies. Drinking unsafe water was associated with a higher risk of toxoplasmosis than drinking pipe water, with borderline statistical significance ( $p = 0.08$ ) (table 1).

## DISCUSSION

A wide variability in the prevalence of toxoplasmosis among pregnant women has been reported worldwide. The present study observed a 23.9% prevalence of anti-toxoplasma antibodies in pregnant women in a rural area of southern Ethiopia, which is higher than that observed in another study in Felege Hiwot Referral Hospital, in Bahi Dar, northwest Ethiopia [5], but similar to that reported in other low-income countries [11]. However, our results are lower than the seroprevalence reported in pregnant women in Addis Ababa (85.4%) [6]; in Jimma town (83.6%) [7]; in four central Ethiopian municipalities (Addis Ababa, Ambo, Debre-Zeit, and Metehara) (81.4%) [8]; in Debre Tabor, northwest Ethiopia (68.4%) [9]; and in the general population of Nazareth, central Ethiopia (60%) [10]. The differences observed may be partly attributable to the different procedures used to measure antibodies, with either EIA [7,8,9] or latex agglutination slide test [5,6,10].

Studies have reported several risk factors for toxoplasma in pregnant women, including age [9], illiteracy [9], contact with cats at home [5,7,9], or consumption of raw/undercooked meat [5] or vegetables [8]. We assessed these known risk factors as well as other potential ones such as gestational age, occupation and various sociodemographic characteristics. However, like the report by Gelaye et al in Addis Ababa [6], our study did not observe any statistically significant association between *T. gondii* infection and any risk factor in pregnant women attending routine antenatal care.

One limitation of our study is the possibility that the method of specimen storage (on Whatman paper) decreased the sensitivity of antibody detection. Moreover, we only measured type IgG antibodies to *T. gondii*, whereas type IgM antibodies are more suggestive of recent infections.

**Table 1****Participant characteristics and seroprevalence of *T. gondii* infection**

Variables (N)	N (%)	Positive N (%)	Negative N (%)	ORc (95% CI)	P value
Age in years (N = 396)					0.7
15-19	55 (13.9)	11(20)	44 (80)	1.0	
20-24	146 (36.9)	37 (25.3)	109 (74.7)	2.1 (0.7, 6.9)	
25-29	115 (29.0)	28 (24.3)	87 (75.7)	1.9 (0.6, 5.6)	
30-34	64 (16.2)	14 (21.9)	50 (78.1)	1.8 (0.6, 5.1)	
35-39	16 (4.0)	6 (37.5)	10 (62.5)	2.4 (0.7, 8.0)	
Residence (N = 401)					0.7
Urban	74 (18.5)	19 (25.7)	55 (74.3)	1	
Rural	327 (81.5)	77 (23.5)	250 (76.5)	0.8 (0.5, 1.6)	
Type of flooring in home (N = 385)					0.1
Cement	41 (10.6)	6 (14.6)	35 (85.4)	1.0	
Soiled	345 (89.4)	85 (24.6)	260 (75.4)	1.9 (0.8, 4.7)	
Knowledge of toxoplasmosis (N = 395)					0.6
Yes	11 (2.8)	0	11 (100)	1.0	
No	384 (97.2)	95 (24.7)	289 (75.3)	N.A	
Occupation (N = 396)					0.5
Housewife	363 (94.0)	90 (24.8)	273 (75.2)	1.0	
Other	23 (6.0)	5 (21.7)	18 (78.6)	0.7 (0.4, 1.2)	
Education (N = 391)					0.07
Illiterate	82 (21)	14 (17.1)	68 (82.9)	3.1 (0.4, 25)	
Read and write	201 (51.7)	52 (25.7)	150 (74.4)	5.2 (0.7, 40)	
High school	91 (23.3)	26 (28.6)	65 (71.4)	6.0 (0.7, 48)	
College and above	16 (4.1)	1 (6.3)	15 (93.8)	1.0	
Gestational age (N = 401)					0.5
1st trimester	75 (18.7)	19 (25.3)	56 (74.7)	1.0	
2nd trimester	158 (39.4)	42 (26.6)	116 (73.4)	1.1 (0.6, 1.7)	
3rd trimester	168 (41.9)	35 (20.8)	133 (43.6)	0.9 (0.5, 1.7)	
Contact with cats (N = 401)					0.5
No	227 (56.6)	57 (25.1)	170 (74.9)	1.0	
Yes	174 (43)	39 (22.4)	135 (77.6)	0.8 (0.5, 1.4)	
Consumption of raw/uncooked meat (N = 400)					0.4
No	144 (36)	38 (26.4)	106 (73.6)	1.0	
Yes	256 (64)	58 (22.7)	198 (65.1)	0.8 (0.5, 1.3)	
Consumption of raw/uncooked vegetable (N = 401)					0.5
No	28 (7.0)	8 (28.6)	20 (71.4)	1.0	
Yes	373 (93.0)	88 (23.6)	285 (93.4)	0.8 (0.3, 1.8)	
Consumption of raw/uncooked milk (N = 401)					0.4
No	30 (7.5)	9 (30.0)	21 (70)	1.0	
Yes	371 (92.5)	37 (23.5)	284 (76.5)	0.7 (0.4, 1.4)	
Source of drinking water (N = 400)					0.1
Pipe	51 (12.8)	7 (13.7)	44 (86.3)	1.0	
Well	61 (15.3)	13 (21.1)	48 (78.7)	1.7 (0.6, 4.6)	
Unsafe <sup>a</sup>	288 (72.0)	75 (26.0)	213 (74.0)	2.2 (0.9, 5.1) <sup>b</sup>	

<sup>a</sup>Unsafe water: river or spring water sources.<sup>b</sup>p=0.08, comparing drink unsafe water with drink safe water (pipe and well)

ORc: crude odds ratio, CI: confidence interval

In conclusion, prevalence of *T. gondii* in pregnant women in our area is lower than that reported elsewhere in Ethiopia and similar to that reported in other low-income countries. In agreement with Gebremedhin et al [8], we believe that an educational program, antenatal screening of pregnant women and further epidemiological studies to uncover the economic and health impact of toxoplasmosis are called for.

## CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest

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None to declare

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