Research Article

Prevalence of *Toxoplasma gondii* and Associated Risk Factors among People Living with HIV at Gondar University Hospital, Northwest Ethiopia

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Background. *Toxoplasma gondii* is an obligate intracellular protozoan parasite and is a major opportunistic pathogen in immune-compromised hosts. This study assessed the prevalence of *T. gondii* and associated risk factors among people living with HIV. **Methods and Materials.** A cross-sectional study was carried out among people living with HIV attending Gondar University Hospital. A structured and pretested questionnaire was used to collect sociodemographic factors, and 10mL of venous blood was collected for anti-*Toxoplasma* antibody test and determination of CD4 levels. Serum was tested in duplicate for anti-*Toxoplasma* antibody using rapid slide agglutination test. **Results.** A total of 170 study subjects were enrolled in the study. Seroprevalence of *T. gondii* among the study participants was 76.5% (95% CI: 69.0–82.8). High proportions of seropositive individuals (64.7%) were found under the child bearing age groups. The mean CD4+ lymphocyte count of HIV monoinfected participants was 495.7 ± 334 cells/mm³ while coinfecting study participants had mean CD4+ lymphocyte count of 403.5 ± 218.7 cells/mm³ with *P* value of 0.01. **Conclusion.** The seroprevalence of *T. gondii* among people living with HIV was high. Cautious followup of HIV-positive patients is needed to prevent development of toxoplasmic encephalitis and other related complications.

1. Introduction

Toxoplasma gondii is an obligate intracellular protozoan of worldwide distribution and is a major opportunistic pathogen in immunocompromised hosts. Infection is mainly acquired by ingestion of food, water or soil that is contaminated with oocysts shed by cats or by eating undercooked or raw meat containing tissue cysts [1].

Toxoplasmosis in patients with AIDS is usually the result of reactivation of latent infection. In HIV-positive people, without previous exposure to *T. gondii*, the acute infection could not be well controlled and in these susceptible hosts

a wide range of infections is expected [2]. Toxoplasmosis occurs mostly in brain that is the frequent clinical finding [3, 4] even in patients with latent toxoplasmosis. Seroprevalence varies greatly in geographical regions within a country and within different ethnic groups according to different environments, social customs, and habits of different populations [5, 6].

There is wide geographic variation in the prevalence of latent *Toxoplasma* infection. Studies from Latin America, Europe, Asia, and Africa have reported a range of prevalence estimates of 30%–75% and prevalence estimates from US studies have had a range of 3%–42% [7, 8]. Worldwide

prevalence rate of latent *Toxoplasma* infections in HIV-infected patients including Ethiopia has been found to vary greatly from 3% to 97% [9, 10].

It is usually subacute in onset with focal neurologic signs frequently accompanied by fever, altered mental state, and headache. Cerebellar, subcortical, or cortical lesions can be present in over 50% of the infected cases, resulting in hemiparesis, ambulatory, and gait or speech abnormalities [11]. A significant proportion of encephalitic patients can also present with neuropsychiatric disorders including psychosis, dementia, anxiety, and personality disorder [12]. However, despite the recognized public health importance of *T. gondii* in different parts of the world, studies on the prevalence of toxoplasmosis among people living with HIV are scanty in Ethiopia and unavailable in the study area.

Despite complications of HIV/AIDS patients due to rampant opportunistic infections, reports on the magnitude of *T. gondii* in such population groups are very minimal. The epidemiology of toxoplasmosis in HIV/AIDS patients should be able to provide us with a better understanding of the clinical scenario. Therefore, the present study assessed the prevalence of *T. gondii* and associated factors among people living with HIV.

2. Methods

2.1. Study Design, Area, and Period. An institution-based cross-sectional study was carried out among people living with HIV from November 2012 to February 2013 at Gondar University Hospital, Northwest Ethiopia.

2.2. Study Population and Sampling Procedures. The source populations for this study were all HIV-positive patients attending Gondar University Hospital. A single population proportion formula was used to estimate sample size. The following assumptions have been made: 95% confidence interval, 93% proportion of *T. gondii* seropositivity among HIV-positive individuals [9], 4% margin of error, and 10% expected nonresponse rate. As a result a total of 170 study subjects were enrolled in the study. Systematic random sampling technique was used to select study participants.

2.3. Data Collection Procedures. Interview using structured and pretested questionnaire was performed to investigate risk factors associated with *T. gondii* infection, including consumption of raw meat and keeping pets (cats and dogs), and to collect data on sociodemographic characteristics of study subject. Ten milliliter (10 mL) of venous blood was aseptically collected for the determination of *T. gondii* seroprevalence and CD4+ levels from each study participant. The CD4+ levels were determined by using BD FACS count flow cytometry [13]. Sera were tested in duplicate for anti-*Toxoplasma* antibody using Toxo Latex manufactured by Linear chemicals S.L, Barcellona, Spain, with a sensitivity of 92% and specificity of 95%. Positive and negative controls were included per each batch of test run to ensure that reagents are working properly, and technical procedures are carried out correctly.

2.4. Data Analysis Procedure. Data were entered and analyzed using SPSS version 20 statistical package. The association between selected variables and seropositivity was analyzed using Chi-square test and *t*-test was used to see the association between mean CD4+ values and seropositivity. *P* value ≤ 0.05 was considered as significant.

2.5. Ethical Considerations. Ethical clearance was obtained from Ethical Review Board of University of Gondar, College of Medicine and Health Sciences. Informed and written consent was obtained from each study participant prior to data collection and all results were kept confidential.

3. Results

3.1. Sociodemographic Characteristics. A total of 170 study subjects were enrolled in the study. Out of these, 96 (56.5%) were females. The mean age of study participants was 33.34 ± 12.34 years. The majority of study participants (91.2%) were from urban residents. More than 89% of the participants were orthodox religion followers and 43.5% were married. Out of the total study participants, 42 (24.7%) were governmental employees followed by daily laborers (21.2%) and housewives (21.1%). More than one-third of study participants were secondary school and above in educational status (Table 1).

3.2. Prevalence of *T. gondii*. Seroprevalence of *T. gondii* among study participants was 130/170 (76.5%) (95% CI: 69.0–82.8). Among seropositive study participants, 71 (54.6%) were females. More than 38% of seropositive individuals were under the age group of 31–40 years followed by 18–30 years (26.2%). All farmers were found to be infected by *T. gondii*. Of all study participants, 137 (80.6%) were on ART while 19.4% were pre-ART and 80% of seropositive study participants were on ART. Among 27 study participants who had contact with dog, 22 (81.5%) were seropositive for *T. gondii*. Of 45 study participants who had contact with cats, 35 (77.8%) were seropositive for *T. gondii*. More than 30% of study participants had frequent experience of raw meat consumption. Of these, 76.9% were seropositive for *T. gondii*. Seventy-nine (60.8%) of seropositive study participants had CD4+ lymphocyte count of ≥ 350 cells/mm³. The mean CD4+ lymphocyte count of HIV monoinfected participants was 495.7 ± 334 cells/mm³, and *T. gondii* seropositive study participants had mean CD4+ lymphocyte count of 403.5 ± 218.7 cells/mm³ with *P* value of 0.01 (Table 2). Statistical analysis was performed to see the association between variables suspected as risk factors and seroprevalence of *T. gondii*; meanwhile all the variables did not show statistically significant association.

4. Discussion

Worldwide prevalence rate of latent *Toxoplasma* infections in HIV-infected patients including Ethiopia has been found to vary greatly from 3% to 97% [9, 10]. In this study, 76.5% of study participants were seropositive for *T. gondii*. This result was lower than study findings of Addis Ababa, Ethiopia

TABLE 1: Sociodemographic characteristics of study participants at Gondar University Hospital from November 2012 to April 2013.

Characteristics	Number (<i>n</i> = 170)	Percent (%)
Age of the respondents		
<18	20	11.8
18–30	48	28.2
31–40	61	35.9
41–50	32	18.8
>50	9	5.3
Sex		
Female	96	56.5
Male	74	43.5
Residency		
Urban	155	91.2
Rural	15	8.8
Religion		
Orthodox	152	89.4
Muslim	16	9.4
Protestant	2	1.2
Marital status		
Single	39	22.9
Married	74	43.5
Divorced	33	19.4
Windowed	24	14.1
Educational status		
No formal education	50	29.4
Primary education	58	34.1
Secondary and above	62	36.5
Occupation		
Government employee	42	24.7
Housewife	36	21.2
Student	19	11.2
Merchant	22	12.9
Daily laborer	36	21.2
Farmer	10	5.9
Others	5	2.9

(93.3%) [9]. The lower result in our study could be due to the diagnostic method used. In contrast, this result was higher than findings in Iran (38.01%) and Malaysia (44.8%) [14, 15]. The difference might be due to the sociocultural differences in keeping dogs and cats at home. Moreover, consumption of raw and insufficiently cooked meat consumption is higher in Ethiopia which is supposed to be a risk factor for *T. gondii* infection.

In this study, more than two-thirds of study participants had cats and/or dogs at their home. Unpredictably, ownership of cats and/or dogs, age, and sex were not statistically significant with seroprevalence of *T. gondii*. This could be due to the small sample size we used as well as the mass coverage of supposed factors irrespective of age and sex. In addition, a study conducted in South Africa, with the same sample size of study participants, showed lower (18.1%) prevalence compared to the current study [16]. Age and sex were not

TABLE 2: Seroprevalence of *Toxoplasma gondii* among study participants at Gondar University Hospital from November 2012 to April 2013.

Characteristics	<i>T. gondii</i>	
	Positive (%)	Negative (%)
Age of the respondents		
<18	15 (11.5)	5 (12.5)
18–30	34 (26.2)	14 (35.0)
31–40	50 (38.5)	11 (27.5)
41–50	23 (17.7)	9 (22.5)
>50	8 (6.2)	1 (2.5)
Sex		
Female	71 (54.6)	25 (62.5)
Male	59 (45.4)	15 (37.5)
Residency		
Urban	119 (91.5)	36 (90.0)
Rural	11 (8.5)	4 (10.0)
Religion		
Orthodox	115 (88.5)	37 (92.5)
Muslim	13 (10.0)	3 (7.5)
Protestant	2 (1.5)	0 (0.0)
Marital status		
Single	28 (21.5)	11 (27.5)
Married	55 (42.3)	19 (47.5)
Divorced	26 (20.0)	7 (17.5)
Window	21 (16.2)	3 (7.5)
Educational status		
Illiterate	41 (31.5)	9 (22.5)
Primary education	42 (32.3)	16 (40.0)
Secondary and above	47 (36.2)	15 (37.5)
Occupation		
Govt. employee	33 (25.4)	9 (22.5)
Housewife	24 (18.5)	12 (30.0)
Student	13 (10)	6 (15.0)
Merchant	16 (12.3)	6 (15.0)
Daily laborer	30 (23.1)	6 (15.0)
Farmer	10 (7.7)	0 (0.0)
Other	4 (3.1)	1 (2.5)
ART		
Pre-ART	26 (20.0)	7 (17.5)
On ART	104 (80.0)	33 (82.5)
CD4+ lymphocyte count		
<200 cells/mm ³	23 (17.7)	4 (10.0)
200–349 cells/mm ³	28 (21.5)	12 (30.0)
≥350 cells/mm ³	79 (60.8)	24 (60.0)
Do you have contact with the cat?		
Yes	35 (26.9)	10 (25.0)
No	95 (73.1)	30 (75.0)
Do you have contact with the dog?		
Yes	22 (16.9)	5 (12.5)
No	108 (83.1)	35 (87.5)

TABLE 2: Continued.

Characteristics	<i>T. gondii</i>	
	Positive (%)	Negative (%)
Source of water for drinking		
Pipe water	123 (94.6)	38 (95.0)
River	3 (2.3)	2 (5.0)
Well	3 (2.3)	0 (0.0)
Other	1 (0.8)	0 (0.0)
Do you boil the water before drinking		
Yes	5 (3.8)	4 (10.0)
No	125 (96.2)	36 (90.0)
Raw meat consumption		
Yes	40 (30.8)	12 (30.0)
No	90 (69.2)	28 (70.0)

statistically significant which is in agreement with our study. All farmers were seropositive in this study which is supported by previously recognized risk factors which are common among farmers.

The majority of seropositive individuals (64.7%) were found under the child bearing age groups (18–40 year) which was also reported in other studies [14, 17]. This might cause congenital anomalies for newborns born from infected mothers not only HIV-positive mothers but also among the general population.

The mean CD4+ lymphocyte count of HIV monoinfected participants was 495.7 ± 334 cells/mm³ while *T. gondii* seropositive study participants had mean CD4+ lymphocyte count of 403.5 ± 218.7 cells/mm³ with *P* value of 0.01. However, it is difficult to explain the effect of CD4+ lymphocyte count level on *T. gondii* infection as recent or remote infection is not determined. The largest proportion (60.8%) of seropositive study participants had CD4+ lymphocyte count of ≥ 350 cells/mm³. Risk of development of toxoplasmic encephalitis for AIDS patients who were seropositive for *T. gondii* is higher within two years after the onset of AIDS, while toxoplasmic encephalitis occurs rarely in AIDS patients who were seronegative for the parasite during pre-AIDS stage [18]. In this study, rapid slide agglutination test was used to detect anti-*Toxoplasma* antibody, hence it is the limitation of the study.

5. Conclusion

The seroprevalence of *T. gondii* among people living with HIV was high. Cautious followup of HIV-positive individuals is needed to prevent development of toxoplasmic encephalitis and other related complications as studies confirmed that *T. gondii* infection was high among people living with HIV.

Conflict of Interests

The authors declare that they have no conflict of interests.

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