

ORIGINAL ARTICLE**Intestinal Parasitosis and Their Associated Factors among People Living with HIV at University of Gondar Hospital, Northwest-Ethiopia****Tegegne Eshetu¹, Getinet Sibhatu¹, Mohammed Megiso¹, Abrham Abere³, Habtamu Wondifraw Baynes², Belete Biadgo², Ayalew Jejaw Zeleke^{3*}****OPEN ACCESS**

Citation: Tegegne Eshetu, Getinet Sibhatu, Mohammed Megiso, Abrham Abere³, Habtamu Wondifraw Baynes², Belete Biadgo, Ayalew Jejaw Zeleke.. Intestinal Parasitosis and Their Associated Factors among People Living with HIV at University of Gondar Hospital, Northwest-Ethiopia. *Ethiopian J Health Sci* 2017;27(4):411. doi: <http://dx.doi.org/10.4314/ejhs.v27i4.12>

Received: February 16, 2017

Accepted: February 24, 2017

Published: July 1, 2017

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Funding: Nil

Competing Interests: The authors declare that this manuscript was approved by all authors in its form and that no competing interest exists.

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ABSTRACT

BACKGROUND: *Most HIV clients die of AIDS related intestinal parasitic infections rather than due to the HIV infection itself. Therefore, this study was aimed at determining the prevalence of intestinal parasite and their associated factors among HIV/AIDS clients at the University of Gondar Hospital, Northwest Ethiopia.*

METHODS: *Institution based cross sectional study was conducted using systematic random sampling technique from March to May 2016. A semi-structured questionnaire was used to collect data. Stool samples were collected and processed using direct wet mount, formol-ether concentration and modified Ziehl-Neelson staining techniques. Besides, blood samples were collected for CD4+ count estimation. Both descriptive and logistic regression analyses were used in data analysis. P-values <0.05 were considered as statistically significant.*

RESULTS: *A total of 223 participants were enrolled in this study, and the prevalence of intestinal parasitosis was found to be 29.1%. The most predominant intestinal parasite detected was cyst of *Entamoeba histolytica* (8.5%) followed by *Ascaris lumbricoides* (6.7%), *Strongyloides stercoralis* (3.6%) and *Cryptosporidium parvum* (3.1%), whereas *Schistosoma mansoni* (0.9%) and *Hymenolepis nana* (0.9%) were the least detected. Absence of toilet (AOR= 19.4, CI: 6.46-58.3), improper hand washing before meal (AOR=11.23, 95% CI: 4.16-30.27 and CD4+ count < 200 cells/mm³ (AOR=33.31, 95% CI: 9.159-121.149) had significant association with prevalence of intestinal parasites.*

CONCLUSION: *The study indicated that intestinal parasites are still a problem among HIV/AIDS patients in the study area. Thus, routine examination for intestinal parasites and interventions should be carried out for better management of clients.*

KEYWORDS: *Intestinal Parasites, HIV/AIDS, associated factors, Gondar, Ethiopia*

INTRODUCTION

Epidemiological surveillance data shows that an estimated 2.1 million people are newly infected with Human Immunodeficiency Virus (HIV) and a total of 36.7 million people are living with HIV at the end of 2015. Moreover, it is also believed that an average of 1.1 million people die annually because of Acquired Immune Deficiency Syndrome (AIDS) worldwide (1). Intestinal parasitic infections are among the most common infections, and almost 80% of AIDS patients die of AIDS-related infections including such infections rather than of the HIV infection itself. This usually occurs late in the course of HIV infection when Cluster for Differentiation (CD4) T-cell count has been severely depleted (2,3).

Intestinal parasites could be opportunistic and non-opportunistic agents that cause diarrhea, which is a common presenting complaint in HIV infected individuals. The devastating effect of HIV on the CD4+ T-cells, coupled with intestinal parasites, will significantly affect patients since conditions of diarrhea will reduce Anti Retroviral Treatment and nutrient absorption (4). Although non-opportunistic parasites such as *Entamoeba histolytica*, *Giardia lamblia*, *Trichuris trichiura*, *Ascaris lumbricoides* and *Ancylostoma duodenal* infect HIV/AIDS patients, opportunistic parasites play a major role in causing chronic diarrhea accompanied by weight loss (5,6). *Cryptosporidium parvum*, *Isospora belli*, *Cyclospora cyatinis* and *Microsporidium* species are among the opportunistic protozoa associated with diarrhea in HIV/AIDS patients (7,8). *Strongyloides stercoralis*, which is a nematode, can also causes diarrhea and overwhelming infestation in patients with immune suppressive disorders (4).

Although there has been an improvement in the survival of people living with HIV, there is still a considerable number of deaths related to AIDS across Ethiopia. Among HIV related health problems, intestinal parasitic infections pose a serious challenge with regard to reducing the morbidity and mortality of these people. Probably, intestinal parasites (IPs) are among the major life threatening infectious diseases among such

individuals [*Unpublished records*]. Therefore, the aim of this study was to determine the prevalence of intestinal parasite and their predisposing factors among HIV/AIDS patients at the University of Gondar Hospital attending ART clinics in order to provide evidence based information, from which medical decisions can be taken.

METHODS AND MATERIALS

Study design, area and period: Institution based cross sectional study was conducted from March to May 2016 at University of Gondar Hospital. University of Gondar Hospital is a teaching referral hospital located 727 km far from Addis Ababa in the Northwest of Ethiopia. Gondar city has a latitude and longitude of 12°37'N 37°28' E with an elevation of 2133 meter above sea level. The city is nicknamed “the Camelot of Africa” due to the presence of a group of royal castles. Based on figures from Central Statistics Agency (2007), Gondar has an estimated total population of 207,044 (9). University of Gondar Hospital is a referral hospital with more than 400 beds. It acts as the referral centre for four district hospitals in the area. It has a range of specialties including pediatrics, surgery, gynecology, psychiatry, HIV care and an outpatient’s clinic. It serves a population of four million across the region. As a university hospital, it plays an important role in teaching medical and other health sciences students (10).

Study population, sample size and sampling procedure: The source population was all HIV positive individuals who came for ART care services at the hospital. The required sample size was calculated using single population proportion formula by considering 17.6% prevalence of intestinal parasites among HIV clients in Dessie, Ethiopia (11), 5% desired precision and 95% confidence interval (CI). This gave us a total sample size of 223.

During participant selection, the previous four months patient flow data were reviewed for estimation. Then, the numbers of patients enrolled were allocated proportionally to each week according to the total number of clients proposed to be attended to during the study period. Depending on this analysis, approximate numbers

of participants who were expected to attend ART service during the three months of study period were determined. Finally, systematic random sampling was used to select study participants. Clients on anti-parasitic therapy or those who had been on it in the past two months were excluded from the study.

Data collection and processing: Data on demographic and behavioral information were collected through face-to-face interview using interviewer-administered questionnaire. Moreover, clients were provided with appropriate specimen container and applicator sticks to give sufficient amount of stool specimen. Parasite infections were diagnosed by examination of stool specimens examined as fresh wet mounts, Formol-ether concentration technique and Modified acid fast stain for detection of different stages of parasites. Blood samples were also collected in heparinated vacutainer tubes for CD4+ T-cell count; using a fully automated fluorescence activated cell sorting (FACS) counter in the ART Clinic of the hospital, Gondar, Ethiopia.

Data quality assurance: The questionnaires were checked for their consistencies and completeness by the investigators. The clients who participated in the study were informed about an appropriate sample collection. Special emphasis was given to diarrhea stool samples by giving priority. In addition, formed and semi-formed stool samples were preserved by formalin for further examination by microscope. Lastly, we performed internal quality control.

Data analysis and interpretation: Data was entered into Epi Info and imported into SPSS version 20 software for analysis. Logistic regression model was employed to assess the potential risk factors. The strength of associations was evaluated by odds ratios (OR) and 95% confidence intervals (CI). Variables that showed co-linearity were omitted, whilst the remaining variables $P < 0.25$ in bivariate analysis were offered to multi-variable logistic regression. P-values < 0.05 were considered as statistically significant.

Ethics approval and consent to participate: The study was conducted after ethical approval was

obtained from the Institutional Ethical Review Committee of the University of Gondar Hospital. Following an explanation of the purpose, the benefits and the possible risks of the study, oral consent was obtained from each studied individual for participation. The interviews with study participants were conducted with strict privacy and confidentiality.

RESULTS

Socio-demographic and general characteristics of the study participants: A total of 223 individuals living with HIV/AIDS were recruited into this study. Among them, 99(44.4%) were males and 124(55.6%) were females. Most of the participants, 81(36.3%), were within the age group of 30-39 years with mean age of 31 ± 4.5 . Out of the 223 study participants, 200 (89.7%) had been on ART over different periods of time while 23(10.3%) were not on ART. In terms of location of residence, the majority were urban dwellers: 193(86.5%) lived in urban areas and 30 (14.5%) in rural areas (Table 1).

Prevalence of intestinal parasites: The overall prevalence of intestinal parasitosis was 65 (29.1%). *E.histoletica* 19(8.5%) was the most predominant parasite detected followed by *A.lumbricoides* 15(6.7%) and *S.sterocoralis* 8(3.6%). On the other hand, *S.mansoni* and *H.nana* were the least detected parasites. Amazingly, equal prevalence of helminthes and protozoa was observed (16.1%). The prevalence of opportunistic intestinal protozoan parasites were 5.8%, and from these 3.1% was due to *Cryptosporidium species* followed by *Cyclospora cyatinsis* 2.7% (Table 2). As far as co-infection is concerned, single infection was identified in 86.1%(56/65) and the remaining 9(13.9%) had mixed infections. Three (33.33%) of the infections were due to *A.lumbricoides* and *E.histoltytica/dipar* (Table 3).

Table 1: Sociodemographic characteristics of the study participants at University of Gondar Hospital ART clinic, Northwest Ethiopia, 2016.

Variables		Frequency	Percent
Gender	Male	99	44.4
	Female	124	55.6
Age in years	0-9	8	3.6
	10-19	11	4.9
	20-29	42	18.8
	30-39	81	36.3
	40-49	57	25.6
	50-59	18	8.1
	60-69	5	2.2
	>70	1	0.4
Marital status	Unmarried	56	25.1
	Married	110	49.3
	Widowed	30	13.5
	Divorced	27	12.1
Educational status	Illiterate	30	13.5
	Primary (Grade 1-8)	125	56.1
	Secondary (Grade 9-12)	58	26
	Higher education	10	4.5
Occupational status	Civil servant	20	9
	Private	50	22.4
	Farmer	22	9.9
	Merchant	53	23.8
	Student	16	7.2
	Driver	8	3.6
	Military	7	3.1
Income	House worker	47	21.1
	<500	17	7.6
	500-100	94	42.2
Residence	>1000	112	50.2
	Urban	193	86.5
ART status	Rural	30	13.5
	Yes	200	89.7
	No	23	10.3

Table 2: prevalence of intestinal parasites among HIV/AIDS patients at University of Gondar hospital, 2016.

Intestinal parasites	Frequency (n)	Percent (%)
Protozoan	36	16.1
<i>Entamoeba histolytica/dispar</i>	19	8.5
<i>Cryptosporidium parvum</i>	7	3.1
<i>Cyclospora cyatini</i>	6	2.7
<i>Giardia lamblia</i>	4	1.8
Helminthes	36	16.1
<i>Ascaris lumbricoides</i>	15	6.7
<i>Strongyloides stercoralis</i>	8	3.6
<i>Trichuris tricurria</i>	3	1.3
Hookworm	3	1.3
<i>Entobius vermicularis</i>	3	1.3
<i>Schistosoma mansoni</i>	2	0.9
<i>Hymenolopis nana</i>	2	0.9
Over all prevalence	65	29.1

Table 3: prevalence of multiple intestinal parasites among HIV/AIDS patients at university of Gondar hospital, 2016).

Intestinal parasites	Frequency	Percent
<i>A.lumbricoid</i> & <i>E.histolytica/dipar</i>	3	33.33
<i>A.lumbricoid</i> & <i>S.stercoralis</i>	2	0.9
<i>A.lumbricoid</i> & <i>G.lamblia</i>	1	0.4
<i>S.stercoralis</i> & <i>E.histolytica/dispar</i>	1	0.4
Hookworm & <i>E.histolytica/dispar</i>	1	0.4
<i>S.stercoralis</i> & <i>H.nana</i>	1	0.4

Prevalence of intestinal parasitic infections based on clinical status:

The prevalence of intestinal parasitic infections was higher on pre-ART 39.1% (9/23) participants than on those who were on ART 28% (56/200). However, there was no significant association ($p = 0.332$) between the overall infection rate and ART status. On the other hand, parasitosis status with respect to the CD4+ T-cell count was variable among the study participants, and there was statistically significant association ($p < 0.001$) between CD4+ T-cell count and the overall parasite prevalence rate among the study participants. High prevalence of intestinal parasitic infections, 73.1% (49/67), was observed in study participants with CD4+ T-cell count of < 200 cells/ μ l, whereas the parasitic infection was found to be 8.6% (5/58) in clients with a CD4+ T-

cell count of > 500 cells/ μ l. The majority, (71.2%), of the study participants with acute/chronic diarrhea were infected by at least one of any intestinal parasites. The distribution of any intestinal parasitic infection in relation to ART, CD4 T-cell count and diarrheal status is presented in Table 4. **Factors Associated with intestinal parasite:** Washing hands before eating food, latrine availability and CD4 level were found to be significantly associated with the prevalence of intestinal parasitosis. Accordingly, individuals who did not wash their hands before eating food were about 18 times more likely to be intestinal parasitosis positive compared to their counter parts (AOR=17.765, 95% CI: 5.780, 54.606). Latrine availability was also found to be independently associated with the outcome variable studied.

Those respondents who did not have latrine were 6.205 times at higher risk of being IP positive than

respondents who had access for latrine (AOR=6.205, 95% CI: 1.745, 22.063) (Table 5).

Table 4: Prevalence of intestinal parasitic infections based on clinical status in HIV/AIDS patients at University of Gondar Hospital, 2016.

Characteristics	Intestinal parasitosis		Chi-square	P-value
	Yes	No		
ART status				
On-ART	56(28%)	144 (72%)	1.232	0.332
Pre-ART	9(39.1%)	14(60.9%)		
CD4 status			66.214	<0.001
<200	49(73.1%)	18 (26.9%)		
200-499	11 (11.2%)	87(88.8)		
>500	5(8.6%)	53(91.4%)		
Acute/Chronic Diarrhea			41.326	<0.001
Yes	42(71.2%)	59(28.8%)		
No	23(23.2%)	99(76.8%)		

Table 5: Multi-variable analysis of factors associated with intestinal parasitosis among HIV/AIDS patients at University of Gondar Hospital, 2016.

Variable	Intestinal Parasitosis		COR, 95%CI	AOR, 95% CI
	Yes, n (%)	No		
Income				
<500	1(94.1)	16(5.9)	.163(.021, 1.284)	.074(.001, 4.449)
500-1000	33(35.1)	61(64.9)	1.414(.782, 2.556)	.810(.302, 2.176)
>1000	31(27.7)	81(72.3)	1	1
Washing hands before eating foods				
Yes	22(12.9)	148(87.1)	1	1
No	43(81.1)	10(18.9)	28.927(12.728, 65.745)	17.765(5.780, 54.606)*
Latrine availability				
Yes	31(17.1)	150(82.9)	1	1
No	34(81)	8(19)	20.565(8.686, 48.685)	6.205(1.745, 22.063)*
CD4 cell count/ul				
<200	49(73.1)	18(26.9)	39.472(14.696, 106.020)	33.311(9.159, 121.149*)
200-499	6(6.5)	87(93.5)	1	1
>500	10 (15.9)	53(84.1)	2.736(.940, 7.962)	3.286(.868, 12.440)

Note: AOR: Adjusted Odds Ratio, COR: Crude Odds Ratio, CI: Confidence Interval: *statistically significant (p < 0.05)

DISCUSSION

This study showed that the prevalence of intestinal parasites among HIV/AIDS clients was found to be 29.1%. This is comparable with studies done in Dessie (28.3%) and in India (32.5%) (11,12). However, it is lower compared to studies conducted in Cameron (59.5%) and Addis Ababa (37.8%) and Yirgalem (35.8%) (13-15). On the other hand, it is higher compared to a previous report from Nigeria (11.4%) (16). These prevalence variations might be due to geographic difference of study population, study methodologies and presence or absence of better followup and better awareness of patients themselves in adopting treatment and prevention against intestinal parasites. As far as the diversity of parasite species is concerned, several (eleven) types of intestinal parasites were detected, seven of which were helminthes and the remaining four were protozoan parasites. Similar to the previous findings reported from other parts of Ethiopia (17,18), *E.histolytica* was the most frequently detected parasite (8.5%) in this study. *A.lumbricoides* was the second (6.7%) most abundant parasite. This finding is in agreement with the study conducted in Dessie Referral Hospital which showed that *A.lumbricoides* was the second most predominant species (11). The presence of soil transmitted helminthes like *A.lumbricoides* and others in this study indicated that HIV infected individuals may fasten the progression of AIDS due to down regulation of the immune system (19).

Importantly, opportunistic intestinal parasites (*Cryptosporidium parvum*, *Cyclospora cayatinensis* and *strongloides stercoralis*) were identified in the study participants. The prevalence of *S.stercoralis* infection in thi study is lower than the previous findings in Ethiopia: 12 % in Yirgalem (20), 7.8 % in Jimma (21), and 10.7% in Bahirdar (near to the study area) (22). This may pinpoint better interventions were being carried out in the study area. However, its prevalence (3.6%) in this study shall not be overlooked and needs special emphasis for further reduction because of its devastating effect on HIV patients and other immune suppressed people. It is accountable for

about 60–85% mortality rate in immune compromised persons. Among such individuals, it may result in hyper infection syndrome due to internal auto infection. Involving such type of infection may result in a devastating condition by serving the larvae as mechanical vectors for different microbial organisms. i.e. juveniles of the parasite can carry and transport intestinal bacteria to the circulation and disseminate to different parts of the body (brain, lung, peritoneum, etc) which may ultimately end with sever health outcomes or death (23,24). The prevalence of other two opportunistic intestinal coccidian parasites is also considerable as they may result in prolonged diarrhea that can reduce antiretroviral treatment and nutrient absorption among HIV/AIDS (4). Moreover, this study found that the presence of acute or chronic diarrhea was statistically associated with the prevalence of intestinal parasitosis in the study population. Many scholars also identified that Intestinal parasitic infections (IPIs) are the most common organisms that result in diarrhea in HIV infected individuals (4,25). Thus, detection of these opportunistic and other parasites among a significant number of HIV infected individuals in this study revealed that people living with HIV/AIDS in the study area are at high risk of developing life threatening conditions.

Northwest Ethiopia is known for high prevalence *S.mansoni* of (26-28). However, this study reported that its prevalence is unusual and low (0.9%). This may be related with the site of residence of the participants since majority were urban dwellers, 193(86.5%). This is due to the fact that most previous studies were done in the rural parts of Northwest Ethiopia where people usually use streams, ponds, rivers and other natural water sources for washing and domestic water consumption. Thus, the likelihood of *S.mansoni* transmission in rural dwellers is higher compared to urban residents that frequently use pipe water for their daily requirements.

The prevalence of intestinal parasites among pre-ART clients was (39.1%), but a decreased rate (28%) among clients with ART adherents was observed. It is in line with that of the studies reported from Dessie (39%), Gondar (43.5%) and

Cameroon (40.5%) (11, 29, 30). Reduction of parasitosis among HIV clients who begun ART followup may indicate the success of intervention efforts in reducing the significance number of opportunistic and other intestinal parasitic infections in the specified high risk group.

This study also tried to describe some proven and hypothesized associated factors and showed an indiscriminate prevalence of intestinal parasitic infection among study participants by age category, sex, level of education, occupation, residence and others. However, it revealed that unavailability of latrine, CD4 status and not washing hands before eating food had statistically significant associations with intestinal parasitosis. Accordingly, individuals who did not have access to latrine in their home or vicinity were 6.2 times more likely to get infected with intestinal parasitosis. Different studies also reported that prevalence of IPIs is associated with unavailability of latrine (31). This is due to the fact that failure to access latrine results in open defecation and environmental contamination. Thus, it facilitates the likelihood transmission of IPIs.

Similarly, improper washing of hands before meal was found to be a determinant factor for intestinal parasitic infections. In view of that participants who did not always practice washing hands before meal were about 18 times (AOR=17.765, 95% CI: 5.780, 54.606) more likely to be infected by intestinal parasites than those who always practiced it. This shows the role of education in preventing IPIs and keeping personal hygiene practices.

In addition, this study indicated that IPIs were found significantly associated with participants having < 200 cells/ul count compared to clients with any of CD4 categories. For instance, having <200 cell/mm³ count were 33.31 times more likely to be infected by the parasites than those who were with the range of 200 and 400 level (AOR=33.31, 95% CI: 9.159, 121.149). Similarly, a previous report from elsewhere in the world suggested that increased frequencies of intestinal parasites were observed in individuals with CD4+ T-cell count <200 cells/ μ l (12). This may be due to the fact that opportunistic parasites are known to resolve spontaneously with immune restoration

among HIV/AIDS patients (8, 32). The association of these parasites for lower 200 cells/mm³ CD4 count is comparable with studies done in other parts of Ethiopia (Dessie, Addis Ababa, Hawasa) (11, 18, 33).

Although this study contributes a piece of information, as its strong side, about HIV/AIDS and intestinal parasitosis to the already existing knowledge, it was only a cross sectional design which might not show temporal relationships and thus the observed associations may not necessarily be causal. In conclusion, intestinal parasitic infections had not gone away and they are still common health problems among HIV positive patients in the study area. Personal hygiene, indiscriminate defecation/not using toilet, and CD4 count <200 cell/ul were variables which showed significant association with intestinal parasitosis. Therefore, early detection and treatment of the parasitic infection, giving health education regarding these parasites are important to reduce parasitic infection of peoples living with HIV.

ACKNOWLEDGEMENTS

We wish to acknowledge the University of Gondar for the financial support of the study. We also acknowledge the priceless support given by all who participated in the study, especially the study participants and data collectors.

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