Non-opportunistic intestinal parasitic infections among HIV-infected individuals at Wolaita Sodo Hospital, South Ethiopia

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Objective: To determine the prevalence of non-opportunistic intestinal helminthic and protozoal infections among HIV-infected individuals and to determine socio-demographic determinants of intestinal parasitosis.

Methods: A cross-sectional study was conducted on HIV-infected individuals attending anti-retroviral therapy clinic of Wolaita Sodo Hospital. Stool in wet mount preparation and formal-ether concentration technique were used to diagnose intestinal parasitic infection. Socio-demographic variables were collected by using questionnaire. Chi-square test was used to test the associations between intestinal parasitosis and socio-demographic variables.

Results: The overall prevalence of non-opportunistic intestinal parasitic infection was 32.4% out of which 11.0% was protozoal infection and 21.4% was helminthic infection. The most common intestinal parasite detected was *Ascaris lumbricoides* with 12.7% prevalence followed by *Giardia lamblia* with 7.5% prevalence. The prevalence of *Strongyloides stercoralis*, hookworm species, Entamoeba histolytica/Entamoeba dispar, Schistosoma mansoni and *Taenia* species was 2.9%, 1.2%, 3.5%, 1.7% and 2.3% respectively. There was no significant difference in prevalence of intestinal parasite infection with regard to age, sex, residence area, job type and religion of participants but there was a significant association between the educational status and intestinal parasitic infection. The prevalence of intestinal parasitic infection was higher among illiterate participants.

Conclusions: *Ascaris lumbricoides* was the most common intestinal parasite detected in HIV-infected individuals. *Giardia lamblia* was the most common protozoal parasite observed. Prevalence of intestinal helminthic infection was higher than protozoal infection. Intestinal parasitosis was significantly associated with an educational status of individuals.

1. Introduction

The intestinal parasites are the protozoan or helminth living within intestine of human and these parasites are more common in tropics and subtropics than elsewhere in the world[1]. The progressive reduction in immunological defense is due to HIV infection predisposing infected individuals, a number of opportunistic intestinal pathogens[2].

Type and prevalence of intestinal parasitic infections vary with the geographical area[3]. Opportunistic and non-opportunistic intestinal parasites frequently encountered in HIV-infected individuals are *Cryptosporidium* species, *Isospora belli*, Microsporidia species, *Giardia intestinalis*, *Entamoeba* species, *Cyclospora*, hookworm, *Taenia* species and *Ascaris lumbricoides*[4].

Different factors such as climatic conditions, poor sanitation, unsafe drinking water and lack of toilet facilities are the main contributors to the high prevalence of intestinal parasitic infection in the tropical and subtropical countries. Especially, fecal contamination of food and drinking water is the main factor to spread intestinal parasites in developing countries[5,6].

The HIV pandemic is a major public health problem for the...
World. An estimated 33 million adults and children are living with the virus globally of which an estimated 22 million adults and children are living with the virus in sub-Saharan African region[7]. Since the beginning of the HIV epidemic in the world, opportunistic infections have been recognized as an important cause for clinical complications among which opportunistic parasitic infections do have a great impact on health of HIV-infected individuals[8].

HIV infection is currently one of the biggest and most deadly infectious diseases. It is believed that there are 1.8 million HIV/AIDS related deaths per year globally. Patients with HIV/AIDS are at higher risk for many diseases. An infection of the gastrointestinal tract is a big problem in HIV/AIDS patients[9-12].

Non-opportunistic intestinal parasites like hookworms, 
*Opisthorchis viverrini* and *Ascaris lumbricoides* were commonly observed in HIV-infected patients regardless of their immunity level. The attention should be given to the importance of tropical non-opportunistic intestinal parasitic infection, HIV-infected individuals[13]. Gastrointestinal infections are responsible for different clinical manifestations in HIV infection, such as diarrhea which occurs in 30%–60% and 90% of HIV/AIDS patients in developed and developing countries respectively[14]. High prevalence of intestinal parasitic infection was observed among HIV/AIDS patients with diarrhea and low CD4+ T-lymphocyte count[15].

The progressive decline and ultimate destruction of immune system functions, which occur due to HIV/AIDS, can result in morbidity and ultimately death due to opportunistic bacterial, viral, fungi and parasitic infections. The outcome of intestinal parasitic infection in HIV/AIDS is dependent on absolute CD4+ T-lymphocyte count in which being lower counts are associated with more severe disease, more atypical disease, and a high risk of disseminated disease[16,17].

In Ethiopia, intestinal parasites are widely occurring due to the low level of environmental sanitation and improper disposal of human excreta. The epidemiological distribution and prevalence of various types of intestinal parasites differ from region to region in Ethiopia because of environmental, social and geographical factors[18,19].

In this area, no study was conducted to determine the types and prevalence of non-opportunistic intestinal parasitic infections among HIV infected individuals as well as the socio-demographic determinants of intestinal parasitosis was not assessed so that this research work was conducted in consideration these gaps.

The aims of this study were to determine the prevalence of intestinal helminthic and protozoal infection among HIV-infected individuals and to determine the associations between intestinal parasitic infections and socio-demographic variables.

2. Materials and methods

2.1. Study area and design

Wolaita Sodo is a town in South-Central Ethiopia and is an administrative center of Wolaita zone of south nations, nationalities and peoples region which is 380 km away from Addis Ababa Wolaita Sodo and has an altitude between 1600 and 2100 m above sea level (6°54’N, 37°45’E/6.900’N, 37.750’E). Sodo possesses a well moderated subtropical highland climate. The area has annual rain fall of 1212 mm and 20 °C mean monthly temperature.

An institution based cross-sectional study was conducted to determine the prevalence of intestinal parasitic infections among HIV infected individuals and to assess an association between sociodemographic variables and intestinal parasitosis.

2.2. Sampling technique

The study participants were clients attending anti-retroviral therapy (ART) clinic of Wolaita Sodo University. Firstly, the participants were asked for being voluntary to participate in this study, secondly, the verbal consent was obtained and finally, all those who were voluntary were included in the study.

2.3. Sample collection and processing

Total of 173 HIV-infected individuals were participated in this study. Firstly, participants provided questionnaire information which assessed the socio-demographic conditions of individuals like age, sex, residence area, educational status and job types, then participants provided stool sample for laboratory examination to diagnose intestinal parasitic infection. Firstly, wet mount preparation was made from fresh specimen and examined microscopically for ova, trophozoite, cyst and larva of parasites. Then, a portion of the same stool specimen was used for formal-ether concentration technique as follow: 10% formalin was mixed with stool sample by using applicator stick which was filtered into the centrifuge tube on which ethyl acetate was added and mixed; then, the preparation was centrifuged at 3 200 r/min for 3 min and the drop of sediment obtained after centrifugation was examined with 10× and 40× objective for ova, cyst and larva of parasites and finally, the type of intestinal parasite identified was recorded on prepared record format in laboratory. Inclusion criteria: HIV-positive patients were treated with ART and pre-ART.

2.4. Data analysis

All data from questionnaire and laboratory investigations were checked for completeness and cleaned for any inconsistencies. Then, data were analyzed by using SPSS version 20. The descriptive statistics was used to determine the frequencies of different variables. The association between intestinal parasitosis and socio-demographic variables was tested by using Chi-square test. For all statistical tests, P ≤ 0.05 was considered as statistically significant.
2.5. Ethical considerations

Ethical approval was obtained from ethical clearance committee of College of Health Sciences and Medicine of Wolaita Sodo University. Informed oral consent was obtained from each participant of the study. Intestinal parasitic infected individuals got appropriate management from clinicians.

2.6. Data quality assurance

Standard operating procedures were followed in all laboratory techniques during data collection. The expiry date of all laboratory equipments and reagents was checked before using them.

3. Result

3.1. Socio-demographic characteristics

Out of total participants of the study, 81 (46.8%) were male and 92 (53.2%) were female. Regarding the religion, 57.2% were protestant, 30.6% were orthodox and 4.6% were catholic. Most of the studied participants were from urban area (86.1%) and the remaining 13.9% were from rural area. Regarding the educational status, majorities (46.2%) completed secondary education and most participants (72.3%) were private workers as shown in Table 1.

Table 1
Socio-demographic characteristics of HIV-infected individuals attending ART clinic of Wolaita Sodo Hospital, South Ethiopia.

| Variables          | Number | Percentage |
|--------------------|--------|------------|
| Sex                | Male   | 81         | 46.8     |
|                    | Female | 92         | 53.2     |
| Age                | 10–14  | 6          | 3.5      |
|                    | 15–19  | 3          | 1.7      |
|                    | 20–24  | 38         | 22.0     |
|                    | 25–29  | 53         | 30.6     |
|                    | 30–34  | 36         | 20.8     |
|                    | 35     | 37         | 21.4     |
| Religion           | Protestant | 100   | 57.8     |
|                    | Orthodox | 53     | 30.6     |
|                    | Catholic | 8      | 4.6      |
|                    | Others  | 12        | 6.9      |
| Residence          | Urban   | 149       | 86.1     |
|                    | Rural   | 24        | 13.9     |
| Educational status | Illiterate | 15    | 8.7      |
|                    | Primary education | 62     | 35.8     |
|                    | Secondary education | 80    | 46.2     |
|                    | College/university | 15    | 8.7      |
| Job types          | Government | 9     | 5.2      |
|                    | Private  | 125       | 72.3     |
|                    | Others   | 39        | 22.5     |

3.2. Prevalence of intestinal parasitic infection among HIV infected individuals

The overall prevalence of non-opportunistic intestinal parasitic infection was 32.4% out of which 11.0% was protozoal infection and 21.4% was helminthic infection. Seven different species of intestinal parasites were detected in this study (Figure 1). The most common intestinal parasite detected was Ascaris lumbricoides (A. lumbricoides) with prevalence of 12.7% followed by Giardia lamblia (G. lamblia) with the prevalence of 7.5%. The prevalence of Entamoeba histolytica (E. histolytica)/Entamoeba dispar (E. dispar) and Schistosoma mansoni (S. mansoni) infection was 3.5% and 1.7% respectively. Hookworm was least prevalent intestinal parasite (1.2%) (Figure 1). The co-infection of S. mansoni and Strongyloides stercoralis (S. stercoralis) was detected in 0.6% of study participants.

Figure 1. Prevalence of intestinal helminth and protozoa infections among HIV-infected individuals attending ART clinic of Wolaita Sodo Hospital, South Ethiopia.
A: S. mansoni + S. stercoralis; B: S. mansoni; C: E. histolytica; D: G. lamblia; E: Hookworm; F: Taenia specias; G: S. stercoralis; H: A. lumbricoides.

3.3. Association between intestinal parasitic infections and socio-demographic variables

Intestinal parasitic infection was not significantly associated with sex of participants, P = 0.12. Similarly socio-demographic factors like age, residence area, job types and religion were not associated with intestinal parasitosis (Table 2). Educational status was significantly associated with intestinal parasitic infection, P = 0.03.

Table 2
The association between intestinal parasitic infections and socio-demographic factors in Wolaita Sodo Hospital, South Ethiopia.

| Variables          | Positive number | Percent | Negative number | Percent | P value |
|--------------------|-----------------|---------|-----------------|---------|---------|
| Sex                | Male            | 31      | 38.3            | 50      | 61.7    | 0.12    |
|                    | Female          | 25      | 27.2            | 67      | 72.8    |         |
| Age                | 10–14           | 3       | 50.0            | 3       | 50.0    | 0.85    |
|                    | 15–19           | 1       | 33.3            | 2       | 66.7    |         |
|                    | 20–24           | 11      | 28.9            | 27      | 71.1    |         |
|                    | 25–29           | 15      | 28.3            | 38      | 71.7    |         |
|                    | 30–34           | 12      | 33.3            | 24      | 66.7    |         |
|                    | > 35            | 14      | 37.8            | 23      | 62.2    |         |
| Residence          | Urban           | 47      | 31.5            | 102     | 68.5    | 0.56    |
|                    | Rural           | 9       | 37.5            | 15      | 62.5    |         |
| Job                | Government      | 3       | 33.3            | 6       | 66.7    | 0.41    |
|                    | Private         | 37      | 29.6            | 88      | 70.4    |         |
|                    | Others          | 16      | 41.0            | 23      | 59.0    |         |
| Educational status | Illiterate      | 9       | 60.0            | 6       | 40.0    | 0.03    |
|                    | Primary education | 21    | 33.9            | 41      | 66.1    |         |
|                    | Secondary education | 19    | 23.8            | 61      | 76.2    |         |
|                    | College/university | 7     | 43.8            | 56      | 56.2    |         |
|                    | Protestant      | 32      | 32.0            | 68      | 68.0    | 0.10    |
|                    | Orthodox        | 13      | 24.5            | 40      | 75.5    |         |
|                    | Catholic        | 4       | 50.0            | 4       | 50.0    |         |
|                    | Others          | 7       | 58.3            | 5       | 41.7    |         |

4. Discussion

The overall prevalence of non-opportunistic intestinal parasitic infection was 32.4% in the study which is comparable to previous
study in other part of Ethiopia and the prevalence of intestinal parasitosis in ALERT hospital was 35%[20]. The prevalence of intestinal protozoal infection of HIV-infected individuals in our study was 11.0% and it was 14.6% in a study done in Hawassa University Referral Hospital, in the same region with this study[21]. The incidence of intestinal helminthic infection was 21.4% which was higher than protozoal infection. An intestinal helminth infection like A. lumbricoides, hookworm, Trichuris trichuria, and S. mansoni is commonly observed in previous studies conducted in Ethiopia but for protozoan parasite types, only two species (E. histolytica and G. lamblia) were commonly reported in country[22,23].

The prevalence of A. lumbricoides infection was 12.7% and it was the most common intestinal parasite detected among HIV-infected individuals. A. lumbricoides is generally the most common intestinal parasite observed in Ethiopia from different reports[23]. This might be due to the favorable environmental condition for survival of ova of A. lumbricoides in country. However, our finding is lower than a report from Jimma, Ethiopia in which the prevalence of ascariasis was 21.67% which may be due to the difference in geographical areas[24].

S. stercoralis was the second common helminth found with 2.9% positivity rate. S. stercoralis was significantly more prevalent among HIV-infected individuals than HIV negatives[25]. In immunosuppressed patients like HIV/AIDS patients, autoinfection of S. stercoralis is speeded up in which large number of larvae are released and cause the dissemination of infection. The clinical syndrome of disseminated strongyloidiasis are gastrointestinal symptoms and respiratory symptoms such as dyspnea, hemoptysis, coughing, or manifestations of asthma and extensive pneumonia as well as secondary infections[3].

Hookworm was the least prevalent helminthic parasite observed among HIV-infected individuals with 1.2% prevalence which might be due to the reason that majority of participants were from urban area that have the habit of wearing shoes which is a preventive practice to control hookworm transmission and this finding is consistent with a report from North Ethiopia (1.1%) by Alemu et al[26]. S. mansoni was detected in 1.7% of the study subjects which is close to a previous report from Ethiopia (0.8%)[27]. S. mansoni was also observed in co-infection with 0.6% prevalence of S. stercoralis. The incidence of coinfection was low in our study which may be due to the regular follow up of health status of HIV-infected individuals at ART clinic of the hospital.

G. lamblia was the most common protozoan parasite detected in this study with prevalence of 7.5%, which is close to a report from Eastern Ethiopia (8.1%)[27]. Previous studies have also indicated the association between G. lamblia and HIV-infection, and HIV causes depressed humoral immunity of an individual which has a significant contributory role in the susceptibility of G. lamblia infection[28]. E. histolytica/E. dispar infection prevalence was 3.5%. E. histolytica E. dispar infection was also indicated as common intestinal parasitic infection among HIV/AIDS infected patients in a previous report from Ethiopia[27]. The prevalence of intestinal parasitic infection was 38.3% in male and 27.2% in female and this difference was not statistically significant, P > 0.05. This indicated that intestinal parasitosis was not significantly associated with sex of study participants. Regarding intestinal parasitic infection among age groups, there was no statistically significant difference in parasitic infection among age groups. Our report is concordant with a study conducted at Northeast Ethiopia, in which socio-demographic characteristics like sex and age group did not show significant association with intestinal parasitic infection[29].

There was no statistically significant difference in intestinal parasitic infection with regard to the residence area of participants, even though a figure was higher in rural than urban (37.5 % vs. 31.5%). The impressive improvement in environmental sanitation like latrine usage in rural areas of Ethiopia is due to the implantation of rural health extension polices in recent years which may contribute to a comparable distribution of intestinal parasitosis among rural and urban areas observed in this study[30]. Similarity, intestinal parasitic infection was not associated with the job types of study participants. Intestinal parasitic infection was significantly associated with the educational status in which it was higher among illiterate participants than others so that educational status was the only socio-demographic factors associated with intestinal parasitosis.

Non-opportunistic intestinal helminthic and protozoal infection was observed as common health problem among HIV-infected individuals in the study area. A. lumbricoides was the most common helminth and G. lamblia was the most common protozoa parasite observed. The prevalence of intestinal helminthic infection was higher than that of protozoal infection. Intestinal parasitic infection was significantly associated with an educational status of participants whereas it has no correlation with sex and age of individuals. Due attention should be given to the laboratory screening and management of intestinal parasitic infection among HIV-infected individuals.

Conflict of interest statement

We declare that we have no conflict of interest.

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