

Research Article

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# Prevalence of Intestinal Parasites and Associated Factors among Adult Pre-ART and ART Patients in Goncha Siso Enesie Woreda, East Gojjam, Northwest Ethiopia, 2014

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## Abstract

**Background:** The prevalence of opportunistic intestinal parasites is expected to be high among Human Immune Deficiency Virus infected populations in developing countries. For many years, intestinal infections caused by opportunistic organisms have been represented as a major problem in immune compromised patients with Acquired Immune Deficiency Syndromes.

**Methods:** Institution based comparative cross sectional study design was conducted in Gendewoyn health center, Goncha Siso Enesie woreda from March to June 2014. A structured questionnaire was administered to all participants to obtain information on socio demographic characteristics and their source of drinking water. For the laboratory test using a direct saline, Dobell's iodine separate wet mount, formal ether concentration and modified Ziehl-Neelsen (Zn) method was applied. The minimum sample size for this quantitative study was 312. Binary and multiple logistic regressions were used to identify factors of intestinal parasite infection and odds ratios, 95% CI and p-value were computed to measure the presence and strength of associations.

**Results:** The overall prevalence of intestinal parasite infections in pre-ART and on-ART was 53.7% and 36.5%, respectively with significant decrease of intestinal parasite in the ART era ( $p < 0.006$ ). Majority of *Cryptosporidium* species infections were found in the pre-ART patients and significantly associated for lower CD4<500 cells/mm<sup>3</sup>. Absence of toilet (AOR=1.80; 95% CI=1.090-2.975), source of water (AOR=8.260; 95% CI=4.659-14.642), rural residence (AOR=2.292, 95% CI=1.386-3.788); CD4 counts (AOR=1.559; 95% CI=1.093-2.722) HAART status: pre ART patients (AOR=2.13, CI, 1.167-3.905) have significant association with prevalence of intestinal parasite infections.

**Conclusion and recommendations:** The most prevalent parasite in the pre-ART subjects were ova of *Ascaris lumbricoides* (15.7%) followed by *Entamoeba histolytica* (14.8%) while on ART patients the most prevalent parasites were ova of *Ascaris lumbricoides* (8.8%) and cyst of *Entamoeba histolytica* (7.4%). The present study revealed the importance of examining pre-ART and on ART patients for intestinal parasite infections. This study reminded health professionals regarding the occurrence of these parasites in this population. Routine examination of stool samples for parasitic infections could significantly benefit pre-ART and on ART patients for early treatment.

**Keywords:** Parasites; Pre-ART; ART; Modified Ziehl-Neelsen

**Abbreviations:** AIDS: Acquired Immune Deficiency Syndrome; AOR: Adjusted Odds Ratio; ART: Anti-Retroviral Therapy; BSC: Bachelor of Science; CD4+ T: Cluster of Differentiation of T lymphocytes; COR: Crude Odds Ratio; EDHS: Ethiopian Demographic and Health Surveys; HAART: Highly Active Anti retro Viral Therapy; HIV: Human Immune Deficiency Virus; IPIs: Intestinal Parasite Infections; IPs: Intestinal Parasites; km: kilometers; spp.: species; SPSS: Statistical packages for social sciences; Ul: Micro Liter; UNAIDS: United nation Acquired Immune Deficiency Syndrome; WHO: World Health Organization

## Introduction

### Background information

Human Immune Deficiency Virus/Acquired Immune Deficiency Syndrome disease is a chronic infectious disease caused by the Human Immune Deficiency Virus, which is characterized by spectrum starting from primary infection, with or without the acute syndrome, followed by a relatively long period of asymptomatic stage after which in most patient's progress to advanced and life threatening disease [1].

Intestinal parasitic infections are distributed virtually throughout the world, with high prevalence rates in many regions. Amoebiasis,

Ascariasis, Hookworm infection and Trichuriasis are among the ten most common infections in the world [2].

Intestinal parasites are parasites that populate the gastro-intestinal tract in humans and other animals. These parasites can live throughout the body, but most prefer the intestinal wall. The two main types of intestinal parasites are helminthes and protozoa. The major groups of parasites include protozoa's and parasitic worms (helminths). Of these, protozoans, including *Cryptosporidium*, *Microsporidia* and *Isospora*, are most common in HIV-infected persons. Each of these parasites can infect the digestive tract and sometimes two or more can cause infection at the same time [3].

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For many years, intestinal infections caused by opportunistic organisms have represented a major problem in immune compromised patients with AIDS. In western countries a decreased incidence of parasitic intestinal infection has been registered as a result of immunological reconstitution in patients receiving HAART. In developing countries where antiretroviral treatments are not available IP's were still play a major role in the morbidity and mortality of AIDS patients. In Sub-Saharan Africa diarrheal disease and AIDS take the fourth and first place among the leading causes, burden and death, respectively [4]. Recent studies have shown that parasitic infections could disturb the balance of anti-HIV immune responses and contributed to HIV replication [5].

### Statement of the problem

Globally, an estimated 35.3 million people were living with HIV in 2012. An increased from previous years as more people are receiving the life-saving antiretroviral therapy. There were 2.3 million new HIV infections globally, showing a 33% decline in the number of new infections from 3.4 million in 2001. At the same time the number of AIDS deaths is also declining with 1.6 million AIDS deaths in 2012, down from 2.3 million in 2005. Sub-Saharan Africa still bears a disproportionate share of the global HIV burden. It accounts 68% of the global HIV burden in 2012 [6].

In 2012, 9.7 million people in low- and middle-income countries received antiretroviral therapy, representing 61% of all who were eligible under the 2010 World Health Organization HIV treatment guidelines. However, under the 2013 WHO guidelines, the HIV treatment coverage in low- and middle-income countries represented only 34% of the 28.6 million people eligible in 2013. Antiretroviral therapy not only prevents AIDS-related illness and death: it also has the potential to significantly reduce the risk of HIV transmission and the spread of tuberculosis. From 1996 to 2012, antiretroviral therapy averted 6.6 million AIDS-related deaths worldwide, including 5.5 million deaths in low- and middle-income countries. But despite historic gains in expanding treatment services, efforts to reach universal treatment access face considerable challenges [7]. Ethiopian Demographic and Health Survey 2011 report showed the national over all prevalence of HIV/AIDS is 1.5% [8].

Parasitic infections, caused by intestinal helminths and protozoan parasites, are among the most prevalent infections in humans in developing countries. In developed countries, protozoan parasites more commonly cause gastrointestinal infections compared to helminths. Intestinal parasites cause a significant morbidity and mortality in endemic countries [9]. The public health importance of intestinal parasites in most developing countries has become prominent with the co-occurrence of malnutrition and HIV/AIDS. Due to lack of appropriate handling of food and drinking water, the prevalence of opportunistic intestinal parasites is expected to be high among HIV infected populations in developing countries [10]. Almost 80% of AIDS patients die from AIDS-related infections including intestinal parasites rather than HIV infection itself [11].

### Significance of the study

This study provides body of knowledge of intestinal parasite prevalence of pre-ART and ART patients in health centers and provides information about associated factors towards IP prevalence among HIV/AIDS patients. It also provides information for the clinicians and the woreda health office to care their patients. Finally it may serve as a stepping stone for further studies.

## Objectives

### General objective

To compare prevalence of intestinal parasites and associated factors among adult pre-ART and on ART patients in Goncha Siso Enesie Woreda, East Gojjam, Northwest Ethiopia, 2014

### Specific objectives

- To compare prevalence of IP in adult HIV/AIDS patients who are pre-ART and on ART.
- To identify associated factors for IP prevalence of adult pre-ART and on ART patients.

## Materials and Methods

### Study area

The study was conducted in Goncha Siso Enesie Woreda which has a population of 165,218 (Source: 2005 woreda health office report). There are 38 health posts and 7 health centers in the woreda. Only one health center provides ART service with a total client of 222 pre-ART patients and 453 on ART patients in the woreda. The ART clinic provides the service for a total of 675 pre ART and on ART clients. One BSC nurse and one diploma clinical nurse who took basic ART training provides the service (Source: 2005 Goncha Siso Enesie woreda. health office report).

### Study design

Comparative cross sectional study design was conducted in Gendewoyn health center, Goncha Siso Enesie Woreda conducted from March to June 2014.

### Source population

The source population was all HIV/AIDS patients in Goncha Siso Enesie Woreda.

### Study population

Adult HIV/AIDS patients in pre ART and on ART who came to Gendewoyn Health Center during the data collection period.

### Sample size determination

The required sample size of the study participants was determined by double population proportion formula. Assumptions; Z=standardized normal distribution value for the 95% CI, which is 1.96 for sample size determination. Proportion taken from previous study: Dessie Hospital; Proportion of pre-ART ( $p_1$ )=39%, Proportion of on-ART ( $p_2$ )=17.6%, (20) Marginal error ( $w$ )=5%.

Double population proportion

$Z_{\alpha/2}=1.96$ , type one error 5%

$Z\beta=0.84$ , 80% power

$P_1$ : IP prevalence of pre ART HIV/AIDS patients=39%,

$P_2$ : IP prevalence of on ART HIV/AIDS patients=17.6,

$r=1/2$  (one part of pre ART HIV+ and two part on ART HIV+ patients will be used)

$p = \frac{p_1 + r p_2}{r + 1} = \frac{0.39 + 0.5(0.176)}{1 + 0.5} = \frac{0.478}{1.5} = 0.3186$

$$n1 = \frac{[\alpha 1 \sqrt{2 \sqrt{(1+1/r)} p (1-p) + \beta \sqrt{p1 (1-p1) + p2 (1-p2)} / r] 2}{(P1-p2)^2}$$

This gives 104 pre ART and 208 on ART patients.

A total sample size of 312 was used.

## Sampling procedure

The study was conducted in Goncha Siso Enesie Woreda which was selected purposively. Gendewoyn Health Center is the only health center in the Woreda that provides the ART service and selected for the study. The sampling procedure was by using consecutive sampling. There were 675 pre ART and on ART HIV/AIDS patients. By dividing 675 to 312 it gives 2. Every other adult pre-ART and on ART patients who came to the ART clinic to pick up their ART drug during the data collection period (from January to February 2014) were included.

## Inclusion criteria

HIV/AIDS patients of age  $\geq 18$  years who were available at the data collection period in Gendewoyn Health Center and were willing to participate in the study.

## Exclusion criteria

Patients who live less than 6 months in the woreda during the study period.

## Variables

**Dependent variables:** Prevalence of IP among adult HIV/AIDS patients.

**Independent variables:** Age, sex, CD4+ T lymphocyte counts, source of drinking water, place of residence, WHO staging, level of education, ART status (pre-ART or on ART), presence or absence of latrine.

## Data collection procedure

A structured questionnaire was administered to all participants to obtain information on socio demographic characteristics and their source of drinking water. The questionnaire was pretested on 10% of the size of the study participants before one week of the actual study in Enebsie Sar Midir Woreda, Mertolemaria (name of neighboring woreda health center) Health Center ART clinic.

## Data collection instrument

Structured questionnaire was administered to all participants to obtain on socio demographic characteristics and their source of drinking water. Laboratory results were obtained from microscopic observation.

**Personnel:** The research team included principal investigator, two laboratory technicians for laboratory investigation, one BSC nurse and one clinical nurse who work in the ART clinic for interviewing, two supervisors and two advisors from Debre Markos University.

## Laboratory procedure

Stool collection and examination for laboratory was supervised and checked by the principal investigator. Fresh stool was collected by wide mouthed clean cup. The stool examination was performed in three ways. A direct saline and Dobell's iodine separate wet mount was examined x10 and x40 objective for the presence of helminthes, flagellates and cysts of flagellates. Formal ether concentration (for low

concentrated parasites in stool) and formal ether concentration (for oocyst of *Cryptosporidium parvum* and *Isospora belli*) was performed [12].

**Data quality and laboratory test assurance:** The quality of data on socio demographic characteristics and their source of drinking water were assured by proper designing and pre-testing of the structured questionnaires. Training was given for data collectors, supervisors and laboratory examiners by the principal investigator for a day before and one day after pretest. The training included discussion on the objectives, contents of the questionnaire, procedures, data collection techniques, labeling, laboratory result writing training and confidentiality of the responses. Every day after data collection, questionnaires were reviewed and checked for completeness by the supervisors and principal investigator. Based on the review the necessary feedback was offered to data collectors in the next morning. Laboratory reagents were tested using known positive and negative samples for the sensitivity and specificity of the test. Each laboratory procedure, test, labeling, and laboratory result writing training was given for the laboratory personnel.

## Ethical consideration

The thesis was reviewed and approved by Medicine and Health Science College Review Committee and permission to conduct this study was obtained from Goncha Siso Enesie Woreda Health Office. All selected participants were asked and informed about the study and laboratory test in order to obtain their verbal consent before administering questionnaires and laboratory tests. Participants were also informed that they have full right to discontinue or refuse to participate in the study. They were also informed that all data obtained from them was kept confidential. Intestinal parasite tested positive patients were treated by dealing with the health center head and by the researcher.

## Results

### Socio-demographic characteristics of the study participants

A total of 312 study adult participants both pre-ART and on ART from Gendewoyn health center were examined for intestinal parasite infections. Adult Pre ART study participants comprised 108 (34.6%) and the remaining adults 204 (65.4%) were on ART. The sex distribution of participants showed majority of pre-ART 78 (72.2%) were females. On the ART group 144 (70.6%) were females.

The age range of the study participants 48 (44.4%) of pre ART participants were in the age range of 25-34 years and 28 (25.9%) were in the age range of 18-24 years. On the ART group 82 (40.2%) were in the age range of 25-34 years and 66 (32.4%) were in the age range of 35-44 years.

Majority of the study participants 48 (44.4%) and 85 (41.7%) were farmers on pre ART and on ART, respectively. Their educational distribution showed that 68 (63%) and 135 (66.2%) pre ART and on ART subjects were unable to read and write respectively (Tables 1 and 2).

### Prevalence of intestinal parasites in pre ART and on ART study participants

A total of 312 stool samples both from pre ART and on ART study participants were collected and examined for intestinal parasites. During microscopic examination of stool samples eleven types of intestinal parasites were identified. The most frequently detected parasites were A. Lumbricoides (11.2%) and Entamoeba histolytica/dispar (10.9%) (Table 3).

Variables		Pre-ART n=108		On ART n=204		Total n=312	
		Frequency	Percent	Frequency	percent	Frequency	Percent
Sex	Male	30	27.8	60	29.4	90	28.8
	Female	78	72.2	144	70.6	222	71.2
Age	18-24	28	25.9	16	7.8	44	14.1
	25-34	48	44.4	82	40.2	130	41.7
	35-44	22	20.4	66	32.4	88	28.2
	>44	10	9.3	40	19.6	50	16
Residence	Urban	45	41.7	102	50	165	52.9
	Rural	63	58.3	102	50	95	47.1
Occupation	Government employed	4	3.7	6	3	10	3.2
	Farmer	48	44.4	88	43	136	43.6
	Student	8	7.4	5	2.5	13	4
	Merchant	24	22.3	51	25	75	24
	Unemployed	7	6.5	14	7	21	6.7
	Daily laborers	17	15.7	40	19.5	57	18
Educational status	Cannot read and write	68	63.0	135	66.1	203	65
	Can read and write	32	29.6	56	27.5	88	28
	Secondary school	5	4.6	11	5.4	16	5
	College and above	3	2.8	2	1.0	5	2
Religion	Orthodox	108	100	204	100	312	100
	Muslim	0	0	0	0	0	0
	Protestant	0	0	0	0	0	0
	others	0	0	0	0	0	0
Ethnicity	Amhara	108	100	204	100	312	100
	Oromo	0	0	0	0	0	0
	Tigray	0	0	0	0	0	0
	Others	0	0	0	0	0	0

**Table 1:** Socio demographic characteristics of adult pre- ART and on ART HIV/AIDS patients in Gendewoyn Health Center March to June, 2014.

Variables		Pre-ART n=108		On ART n=204		Total n=312	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
CD4 count	<=500	40	37.0	54	26.5	94	30.1
	>500	68	63.0	150	73.5	218	69.9
WHO staging	Stage 1	21	19.4	40	19.6	61	19.6
	Stage 2	40	37.0	63	30.9	103	33
	Stage3	43	39.8	87	42.6	130	41.4
	Stage4	4	3.7	14	6.9	18	6
Access of latrine	Yes	54	50	112	54.9	166	53.2
	No	54	50	92	45.1	146	46.8
Eat raw meat	Yes always	5	4.6	2	0.9	7	2.2
	Yes sometimes	101	93.5	8	3.8	109	34.9
	No	2	1.9	194	95.3	196	62.9
Source of drinking water	Tape water protected	48	44.4	114	55.9	162	52
	River water unprotected	60	55.6	90	44.1	150	48
Shoes wearing	Yes I wear it always	27	25	99	48.5	126	40.4
	Yes I sometimes wear it	71	65.7	84	41.2	155	49.6
	No	10	9.3	21	10.3	31	10
Eat raw vegetables	Yes always	3	3	4	2	7	2.4
	Yes sometimes	1	0.9	1	0.5	2	0.6
	No	104	96.1	199	97.5	303	97
Type of your housing	Cemented wall and floor	1	0.9	1	0.5	2	0.6
	Un cemented wall and floor	107	99.1	203	99.5	310	99.4
Boiling drinkable water	Yes	1	0.9	2	0.9	3	0.96
	No	107	99.1	202	99.1	309	99.04
Washing hand before meal	Yes always	105	97.2	200	98	305	97.8
	Yes sometimes	1	0.93	2	1	3	0.96
	Not at all	2	1.85	2	1	4	1.28

**Table 2:** Clinical and hygiene related characteristics of adult pre- ART and on ART HIV/AIDS patients in Gendewoyn Health Center March to June, 2014.



The total prevalence of IP both in the pre ART and ART study participants were 42.6%. The overall prevalence of IP in the pre ART was 53.7% of which helminths were 24% and protozoans were 29.7%. The most prevalent parasite in the pre-ART study participants were ova of *Ascaris lumbricoides* (15.7%) followed by *Entamoeba histolytica* (14.8%). The prevalence of opportunistic parasites in the pre-ART study participants was 11.1%. The most prevalent opportunistic parasites in the pre ART were *C. parvum*, *S. stercoralis* and *I. belli* 4.6%, 3.7% and 2.8%, respectively.

The overall prevalence of IP on the ART study participants was 36.8%. The prevalence of helminths was 14.75% and the prevalence of protozoans in the ART study participants were 22.1%. The most prevalent parasites were ova of *Ascaris lumbricoides* (8.8%) and cyst of *Entamoeba histolytica* (7.4%).

Parasites	Pre-ART(n=108)	On ART(n=204)
<b>Protozoans</b>		
1 Trophozite of <i>G. lamblia</i>	5 (4.6%)	12 (5.9%)
2 Cyst of <i>G. lamblia</i>	3 (2.8%)	6 (2.9%)
3 Trophozite of <i>E. histolytica</i> dispar	4 (3.7%)	2 (1%)
4 Cyst of <i>E. histolytica</i>	12 (11.1%)	16 (7.8%)
5 <i>I. belli</i>	3 (2.8%)	1 (0.5%)
6 <i>Cryptosporidium</i> spp.	5 (4.6%)	8 (3.9%)
<b>Helminths</b>		
1 <i>Ascaris lumbricoides</i>	17 (15.7%)	18 (8.8%)
2 <i>Strongyloides stercoralis</i>	4 (3.7%)	1 (0.5%)
3 <i>Taenia</i> species	5 (4.6%)	4 (2.0%)
4 <i>H. nana</i>	0	6 (2.9%)
5 Hookworm	0	1 (0.5%)
<b>Total</b>	<b>58 (53.7%)</b>	<b>75 (36.8%)</b>

#### Double infections

Pre-ART patients			On ART patients	
	Frequency	Percent	Frequency	Percent
Yes	4	3.7	2	1.0
No	104	96.3	202	99.0
<b>Total</b>	<b>208</b>	<b>100.0</b>	<b>204</b>	<b>100.0</b>

**Table 3:** Prevalence of IP of single and double infection of adult pre-ART and on ART HIV/AIDS patients in Gendewoy Health Center, March to June, 2014.

The prevalence of opportunistic IP on ART study participants were *C. parvum* (3.9%), *I. belli* (0.5%) and *S. stercoralis* (0.5%). This showed the overall prevalence of opportunistic parasite in pre-ART study participants (11.1%) was higher than on ART study participants (4.9%). The overall prevalence of IP in the pre ART (53.7%) was higher than on ART (36.8%) study participants.

In the pre-ART study participants 3.7% of them have double infection whereas on ART study participants 0.5% had double infection of IP. The study participants who were pre-ART consisted of 68 (62.9%) with CD4 count  $\leq$  500 cells/ul, 40(37.1%) with CD4 count  $>$ 500 cells/ul. Almost 65% of opportunistic parasites in the pre ART group were found with CD4 counts  $\leq$ 500 cells/ul. On the ART group 150 (73.5%) patients were CD4 counts  $<$ 500 cells/ul and 54 (26.5%) were CD4 counts  $>$ 500 cells/ul. 61 parasites with CD4 count  $\leq$  500 cells/ul and 14 parasites with CD4 counts  $>$ 500 cells/ul were identified on ART patients.

CD4 count has no significant association with intestinal parasites on ART patients (AOR=1.631, CI 0.673-3.954).

On the multiple logistic regression rural adult pre ART patients of rural residence were 3.766 times (COR=3.766, CI 1.418-10.005) more likely to develop IPI than those urban residences whereas on ART patients rural residents were 1.927 times (COR=1.927, CI 1.035-3.972) more likely to develop IPI than urban residents. Accessibility of latrine for both pre ART and on ART patients in the multiple logistic regression analysis showed almost similar association those who did not have latrine were 2 times (pre ART COR=1.718, CI 1.644-4.585, on ART COR=1.496 CI 1.015-3.13) (Tables 3 and 4) more likely to develop IPI than those who have latrine. Pre ART patients with their drinking source of water were from river unprotected were 5 times (COR=5.650 CI 2.122-15.042) times more likely to develop IPI than those from protected/tape water sources (Table 3). Whereas on ART patients their source of drinking water were from river unprotected were 14 times (COR=14.856, CI 6.82-32.363) more likely to develop

Variables		Pre-ART n=108		COR (95%CI)	P value	AOR (95% CI)	P value
		Positive N (%)	Negative N (%)				
Residence	Urban	17 (37.8%)	28 (62.2%)	1*		1*	
	Rural	41 (65%)	22 (35%)	3.070 (1.387-6.795)	0.006	3.766 (1.418-10.005)	0.008
CD4 count	$\leq$ 500	43 (63.2%)	25 (36.8%)	2.867 (1.278-6.431)	0.011	1.520 (1.552-4.185)	0.024
	$>$ 500	15 (37.5%)	25 (62.5%)	1*		1*	
WHO staging	Stage 1	9 (42.8%)	12 (57.2%)	1*		1*	
	Stage 2	22 (55%)	18 (45%)	1.6296 (0.174-1.685)	0.289	0.732 (0.207-2.582)	0.627
	Stage 3	17 (39.5%)	26 (60.5%)	0.871 (0.032-0.351)	0.000	0.139 (0.038-0.511)	0.003
	Stage 4	2 (50%)	2 (50%)	1.33 (0.103-13.951)	0.884	2.848 (0.191-10.41)	0.448
Access of latrine	Yes	26 (48%)	28 (52%)	1*		1*	
	No	32 (59%)	22 (41%)	1.566 (1.073-3.354)	0.024	1.718 (1.644-4.585)	0.028
Residence distance from H/C	$\leq$ 5 km	27 (71%)	11 (29%)	1*		1*	
	$>$ 5 km	31 (44.3%)	39 (55.7%)	0.324 (0.139-0.754)	0.009	0.662 (0.229-1.9180)	0.447
Source of drinking water	Tape water protected	16 (33%)	32 (67%)	1*		1*	
	River water unprotected	42 (70%)	18 (30%)	4.667 (2.065-10.548)	0.000	5.650 (2.122-15.042)	0.001
Shoes wearing	Yes I wear it always	9 (90%)	1 (10%)	1*		1*	
	Yes I sometimes wear it	39 (54.9%)	32 (45.1%)	0.135 (0.194-1.199)	0.117	0.881 (0.277-2.801)	0.830
	No	10 (37%)	17 (63%)	0.065 (0.167-1.128)	0.015	0.124 (0.012-1.323)	0.084

**Table 4:** Association of socio-demographic and clinical factors of adult pre ART HIV/AIDS patients using binary and multinomial logistic regression with prevalence of intestinal parasite, Gendewoy Health Center March to June, 2014.

IPI than from protected water sources. Over all in the multinomial analysis shoe wearing, WHO staging and residence distance showed likely association for intestinal parasite infections.

### Associated factors for IP among adult HIV/AIDS patients attending Gendewoyn health center, ART clinic using multiple logistic regression

The multivariate analysis showed that persons whose source of drinking water was from rivers/unprotected were 8 (AOR=8.260, CI; 4.659-14.642) times more developed IP than those from tape/protected water sources. The multivariate analysis showed that HAART status has association for intestinal parasite infections. Those pre-ART patients have the probability of developing intestinal

parasite infections twice (AOR=2.13, CI, 1.167-3.905) than those on ART patients.

HIV/AIDS patients from rural residence developed intestinal parasite infection 2 (AOR=2.292, CI; 1.386-3.788) times more than urban residents. Concerning CD4 counts HIV/AIDS patients whose CD4 counts <=500 cells/ul were 2 (AOR=1.559, CI; 1.093-2.722) times more likely to develop intestinal parasite infections than those whose CD4 counts >500 cells/ul. Those who have toilets developed intestinal parasite infections 2 (AOR=1.802, CI; 1.090-2.975) times more than those who did not have latrines. The overall prevalence of IP in the pre ART (53.7%) was higher than on ART (36.8%) subjects. Indicating statistically significant decrease of intestinal parasite in ART patients (p<0.006)

Variables		On ART n=204		COR(95%CI)	P value	AOR(95%CI)	P value
		Positive N (%)	Negative N (%)				
Residence	Urban	27 (26.5%)	75 (73.5%)	1*		1*	
	Rural	48 (47%)	54 (53%)	2.469 (1.373-4.441)	0.003	1.927 (1.035-3.972)	0.025
CD4 count	<=500	61 (40.6%)	89 (59.4%)	1.958 (0.256-1.018)	0.056	1.631 (0.673-3.954)	0.279
	>500	14 (26%)	40 (74%)	1*		1*	
WHO staging	Stage 1	10 (71.4%)	4 (28.6%)	1*		1*	
	Stage 2	38 (43.7%)	49 (56.3%)	0.310 (0.364-2.233)	0.823	0.536 (0.185-1.549)	0.249
	Stage3	17 (30%)	46 (70%)	0.147 (0.187-0.987)	0.047	0.227 (0.083-0.626)	0.004
	Stage4	10 (25%)	30 (75%)	0.133 (0.034-0.521)	0.004	0.055 (0.011-0.278)	0.000
Access of latrine	Yes	35 (31%)	77 (69%)	1*		1*	
	No	40 (43%)	52 (57%)	1.692 (1.024-3.005)	0.032	1.496 (1.015-3.134)	0.028
Residence distance from H/C	<=5 km	36 (44.4%)	45 (55.6%)	1*		1*	
	>5 km	39 (31.7%)	84 (68.3%)	0.580 (0.325-1.036)	0.066	0.848 (0.400-1.800)	0.668
Source of drinking water	Tape water protected	16 (14%)	98 (86%)	1*		1*	
	River water unprotected	59 (66%)	31 (34%)	11.654 (5.88-23.110)	0.000	14.856 (6.82-32.363)	0.000
Shoes wearing	Yes I wear it always	11 (52.4%)	10 (47.6%)	1*		1*	
	Yes I sometimes wear	32 (38.1%)	52 (61.9%)	0.559 (0.422-1.427)	0.415	0.944 (0.432-2.0620)	0.872
	No	32 (32%)	67 (68%)	0.434 (0.167-1.128)	0.087	0.563 (0.166-1.905)	0.335

**Table 5:** Association of socio-demographic and clinical factors of adult on ART HIV/AIDS patients using binary and multinomial logistic regression with prevalence of intestinal parasite, Gendewoyn Health Center, March to June, 2014.

Variables		Both pre ART and on ART n=312		COR(95%CI)	P value	AOR(95%CI)	P value
		Positive N (%)	Negative N (%)				
Residence	Urban	44 (30%)	103 (70%)	1*			
	Rural	89 (54%)	76 (46%)	2.741 (1.718-4.374)	0.000	2.292 (1.386-3.788)	0.001
CD4 count	<=500	104 (47.7%)	114 (52.3%)	2.045 (1.225-3.412)	0.006	1.559 (1.093-2.722)	0.021
	>500	29 (30.8%)	65 (69.2%)	1*			
WHO staging	Stage 1	19 (54.3%)	16 (45.7%)	1*			
	Stage 2	60 (47.3%)	67 (52.7%)	0.754 (0.357-1.457)	0.363	0.664 (0.317-1.391)	0.278
	Stage 3	34 (32%)	72 (68%)	0.397 (0.147-0.558)	0.000	0.272 (0.1350.551)	0.000
	Stage 4	12 (27.3%)	32 (72.7%)	0.316 (0.075-0.684)	0.008	0.231 (0.070-0.765)	0.005
HAART STATUS	ART	75 (36%)	129 (64%)	1*		1*	
	Pre-ART	58 (54%)	50 (46 %)	1.995 (1.243-3.203)	0.004	2.135 (1.167-3.905)	0.019
Access of latrine	Yes	61 (37%)	105 (63%)	1*			
	No	72 (49%)	74 (51%)	1.675 (1.065-2.633)	0.026	1.801 (1.090-2.975)	0.111
Residence distance from H/C	<=5 km	70 (36%)	123 (64%)	1*			
	>5 km	63 (53%)	56 (47%)	1.976 (0.318-0.805)	0.004	0.727 (0.432-1.222)	0.513
Source of drinking water	Tape water protected	32 (20%)	130 (80%)	1*			
	River water unprotected	101 (67%)	49 (33%)	8.374 (4.999-14.025)	0.000	8.260 (4.659-14.642)	0.000
Shoes wearing	Yes I wear it always	20 (64.5%)	11 (35.5 %)	1*			
	Yes I sometimes wear it	71 (45.8%)	84 (54.2%)	0.465 (0.364-0.963)	0.035	0.679 (0.400-1.153)	0.639
	No	42 (33%)	84 (67%)	0.275 (0.121-0.627)	0.002	0.306 (0.126-0.741)	0.043

**Table 6:** Association of socio-demographic and clinical factors of both pre ART and on ART HIV/AIDS patients using binary and multinomial logistic regression with prevalence of intestinal parasite, Gendewoyn Health Center, March to June, 2014.

Others like WHO staging, shoes wearing habits and residence distance from health centers have association for intestinal parasite infections (Tables 5 and 6).

## Discussion

This study showed high prevalence of intestinal parasite infections in pre-ART and on ART patients. The overall prevalence of intestinal parasite infections in pre ART and on ART patients were 53.7% and 36.8%, respectively which is higher than a study conducted in Dessie hospital with prevalence of IP infections 39% for pre ART patients and 17.6% for on ART patients [13] and higher than a study conducted in Eastern Ethiopia, Hiwot Fana specialized hospital with prevalence of 45.5% for pre-ART patients and 33.7 % for on ART patients [14]. This may be due to differences in geographic locations and difference in study participants since this study was conducted in rural woreda which may cause the high prevalence. However, the prevalence in this study was lower than a study conducted in Fiche hospital with a prevalence of 70.7% for pre ART patients and 55.1% for on ART patients [15]. This difference may be due to Fiche is so high land than the area in which this study was conducted. The difference of the sampling procedure of the two studies might cause the variations.

The parasite distribution showed that in the pre ART patients the distribution of helminths were 24% which was higher than the distribution of helminthes in Dessie Hospital (7.4%) and distribution of protozoans were 29.7% which was lower than the distribution of protozoans in Dessie Hospital (31%). On ART patients the prevalence of helminthes was 14.75% which was higher than the distribution reported in Dessie Hospital (5.1%) and protozoans were 22% which was higher than the distribution reported in Dessie Hospital (12.5%).

The most frequently identified parasites in the pre-ART patients were ova of *A. lumbricoides* (15.7%) which was higher than a study reported in Dessie Hospital (2.9%), Nigeria (12.1%) [16]. and cyst of *E. histolytica* (11.1%) higher than study in Nigeria (4%) and lower than reported in Dessie Hospital (19.1%). Whereas on the ART patients the most frequently identified parasites were ova of *A. lumbricoides* (8.8%) higher than Dessie Hospital (5.1%) and cyst of *E. histolytica* lower than Dessie Hospital (2.2%) [13], the distribution of *C. parvum* in pre ART patients was 4.6% which was lower than study in China (8.3%) [17] and Nigeria (18.1%) [16].

In both pre ART and on ART patients' ova of *A. lumbricoides* is the most frequently identified parasite. But there is difference in the percentage (15.7% in pre-ART and 8.8% in ART patients) which may be due to pre ART patients have poor adherence of hygienic practices when they prepare foods and poor adherence on the recommended foods. In addition to this most of pre ART patients do not have awareness about HIV/AIDS prevention, transmission, management and opportunistic prevention, management and their outcome unlike patients on ART. This may cause high prevalence of ova of *A. lumbricoides* on pre ART patients.

This study showed that HIV/AIDS patients using river water/unprotected water were more likely to develop intestinal parasite infection which was 8 times more than those who drink tape water/protected (AOR=8.26; CI 4.659-14.642). This is almost in line with a study conducted in Dessie Hospital (6 times) and Nigeria (5 times) [13,16].

HIV/AIDS patients who were rural resident were 2 times more likely to develop intestinal parasite infections than those urban residents

(AOR=2.292, CI: 1.386-3.788). This is due the rural community has lack of pipe water, lack of knowledge regarding with hygienic water and food when it is compared with urban community.

HIV/AIDS patients who did not have latrine were almost 2 times susceptible for IP than those who had latrine (AOR=1.801, CI: 1.090-2.975). This was much lower than in Dessie (8 times) and Nigeria (5 times) [13,16]. The difference may be the present study was conducted in rural area which commonly use open defecation.

In terms of CD4 count; those whose CD4 counts  $\leq$  500 cell/ul, 2 times were more likely to develop IP infections than those whose CD4 counts are  $>$ 500 cells/ul; Which in lines with study in Dessie, Nigeria and China (AOR=1.559, CI: 1.093-2.72) [13,16,17].

HIV/AIDS patients who are pre-ART were twice (2) the probability of developing intestinal parasite than on ART patients.

## Conclusion

This study revealed the importance of examining pre-ART and on ART patients for intestinal parasite infections. Infections with ova of *A. lumbricoides* and *E. histolytica* were the highest distributed parasites for both pre ART and on ART patients and needs care.

Pre ART patients are more susceptible to intestinal parasite infections than on ART patient's particularly rural residents. Hygiene habits like access of latrine and drinking water sources indicating a need for targeted promotion. Opportunistic parasites were highly distributed in pre-ART patients and it was advisable for those patients to start HAART early.

This study makes health professionals regarding the occurrence of these parasites in this population. Routine examination of stool samples for parasitic infections could significantly benefit pre-art and on ART patients for early treatments.

Additionally the study highlights the importance of personal hygiene for preventing intestinal parasite infections for pre-ART and on ART patients especially drinking water source.

## Competing Interest

Authors declare that they have no competing interest in financial, academics, personal ideological, intellectual and commercial interests.

## Recommendations

The findings of this research showed that the prevalence of intestinal parasite infections were high so we recommend clinicians and health professionals to make routine stool examinations for pre ART and on ART patients. The Health Bureau should create awareness towards hygiene components in the rural HIV/AIDS patients specially about latrine utilizations Rural populations should be aware about their drinking water source and the woreda should construct protected water for these communities. The Health Bureau should address and make these lower CD4 count HIV/AIDS patients regularly examine for intestinal parasite infections.

## Authors' Contribution

All authors have equal contribution for this research starting from design, coordination and analysis of the collected data. All authors read and approved the final manuscript.

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