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INTESTINAL PARASITIC INFECTIONS AMONG HIV/AIDS INFECTED AND NON-INFECTED PATIENTS IN EASTERN TIGRAY, NORTHERN ETHIOPIA

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ABSTRACT

Intestinal parasitic infections are among the most common human infections worldwide with a significant role in morbidity and mortality; especially among HIV infected patients. A comparative cross-sectional study was conducted to assess the magnitude of intestinal parasitic infections among HIV infected and non infected patients in Eastern Tigray, Northern Ethiopia. Socio-demographic characteristics and stool samples were collected from all study participants and examined for parasites using Direct microscopic, Formol-ether concentration and Modified acid fast stain techniques. Out of 338 patients, 238 (70.4%) were HIV positive and 100 (29.6%) were HIV negative patients. 231(68.34%) was an overall prevalence of intestinal parasitic infections encountered in this study. Among 238 HIV positive and 100 HIV negative patients, 161(67.6%) and 70(70%) were infected with one or more intestinal parasites respectively with no significant difference between the two study subjects ($P > 0.05$). Among the detected non opportunistic and opportunistic intestinal parasites, *Entamoeba histolytica* 92(27.22%) was the most frequently encountered parasite followed by *Cryptosporidium parvum* 53(15.68%), *Gardia lamblia* 43(12.72%), *Ascaris lumbricoides* 31(9.17%), and *Isospora belli* 24(7.1%), respectively. *Cryptosporidium parvum* was the most common among opportunistic parasites (15.68 vs. 5%) detected followed by *Isospora belli* (8.8 vs. 3%) and *Cyclospora species* (0.42 vs. 0%) among HIV positive and negative patients, respectively. Moreover, the detection rate of most parasites among HIV positive patients was significantly higher among patients with $CD4^+$ count less than 200cells/ µl than other groups. Therefore, periodical detection and treatment of these parasites are vital to assure the life quality of the patients in the study area.

KEYWORDS: Prevalence, Intestinal parasite, HIV positive, $CD4^+$ count, Tigray, Ethiopia.

1. BACKGROUND

Intestinal parasitic infections (IPIs) which are caused by Protozoa and Helminthes are among the most prevalent human infections worldwide.[1] It is estimated that more than 60% of the World's population is infected with intestinal parasites which play a significant role in morbidity and mortality.[1,2] Intestinal parasites as a major concern in most developing countries have been pronounced with the co-occurrence of poverty, malnutrition and HIV/AIDS.[2] Currently dramatic expansion of HIV/AIDS pandemic has brought a significant change in infection rate of intestinal parasites all over the world, especially in developing countries and several other factors also contribute to the expansion and reinvasion of newly emerging intestinal parasites.[3,4]

Opportunistic parasitic infections are a common feature in HIV/AIDS infections where almost 80% of AIDS patients die of AIDS-related infections including intestinal parasites rather than of the HIV infection itself which usually occur late in the course of HIV infection when Cluster of Differeation $(CD4)^+$ T-cell count has been severely depleted mostly below 200cells/mm^3.[5, 6] Depletion of circulating T-cell as a result of HIV infection invariably leads to increased susceptibility to opportunistic intestinal parasites.[6] In addition, intestinal parasitic infestations also are major contributors to morbidity and mortality in both immune compromised and immune competent individuals, especially in HIV infected individuals. [4] Most previous studies were give more attention and consideration on opportunistic intestinal parasites showed that mostly HIV infected individuals are highly infected by these parasites but, non-opportunistic intestinal parasites are also a basic health problems among HIV infected patients and this is due to lack of appropriate diagnostic methods to detect the non opportunistic intestinal parasites.

Like to other developing countries, intestinal parasites are widely distributed in Ethiopia largely due to low level of environmental and personal hygiene, contamination of food and drinking water that results

from improper disposal of human excreta.[7,8] HIV/AIDS is highly distributed throughout the country affecting the population severely and an estimated over two million people were infected with HIV virus.[9] Several studies have been conducted on the issue of intestinal parasites in the country but most of them gave more attention to the distribution of IPI in different communities groups such as preschool children, school children and other individuals confined to campus and refugees rather than in HIV/AIDS infected patients.

Intestinal parasitic – HIV co-infection is one of the major alarmed issues in Ethiopia. This is because; HIV/AIDS has become a major public health concerns in the country. Even though the issues regarding opportunistic intestinal parasitic infection among HIV infected patients have been widely recognized, only few relevant epidemiological investigations have been reported in some part of Ethiopia.[10, 11] However, in Tigray region, particularly in the study area, information regarding Intestinal Parasitic infection among HIV/AIDS infected patients has not been well documented. Therefore, the current study was carried out to assess the Intestinal Parasitic infection among HIV/AIDS infected patients in comparison with non-HIV/AIDS infected patients in Eastern Tigray, Northern Ethiopia.

2. MATERIAL AND METHODS

2.1. Study Area

The study was conducted in Adigrat and Wukro Hospitals, Northern Ethiopia. Adigrat and Wukro hospitals are the main hospitals in Eastern Zone of Tigray region where large population including HIV infected patients of the region were attended their clinical program.

2.2. Study Population and Design

The study population was HIV/AIDS infected and non-infected patients. A comparative cross-sectional study was conducted to assess the infection rate of intestinal parasites among HIV/AIDS infected and non-infected patients in both study hospitals.

2.3. Sample Size and Sampling Technique

The prevalence of intestinal parasites among HIV/AIDS patients was taken as 65%, which is the expected prevalence in the study area and to detect a difference of 15% between the two groups with the assumption of 95% confidence level (CL), power of 80% (0.84) and ratio 2: 1 of those HIV infected and Non- infected groups. Double proportion formula was applied to calculate the sample size which is 238 HIV positive and 100 HIV negative groups. Moreover, the study participants were selected by simple random sampling techniques.

2.4. Stool Sample Collection and Microscopic Examination

After obtaining the ethical clearance, a single fresh stool sample was collected in labeled and cleaned plastic stool cups from each study subjects. After collection, each stool sample was immediately examined by Direct Wet Mount Method using a Normal saline solution (0.85% NaCl solution) in each hospital to detect the cyst and motile trophozoites of intestinal parasites. A portion of each fresh stool sample was taken and preserved with 10ml of 10% formalin and transported to the laboratory of Biology Department, Adigrat University. A small portion of each preserved stool sample was taken and processed by experienced laboratory technician. Briefly, 1gm of each stool sample was placed in clear 15ml conical centrifuge tube containing 7ml of formalin solution by using clean applicator stick. Then the mixture was mixed well. After adding of 3ml diethyl ether to each tube, then content was centrifuged at 1500rpm for 5 minutes. Finally, the supernatant was poured away and wet mount was prepared from the sediment of each tube and examined under a microscope with a magnification power of 10x and 100x.[12]

A small portion of stool sample was processed using the Ziehl Neelsen method to detect the oocyst of opportunistic parasites.[13] Thin smear were prepared for each sample directly from the sediment of concentrated stool and allowed to air dry. The slides were then fixed with Methanol for 5 minutes and stained with Carbol fuchsine for 30 minutes. After washing each slide with tap water, they were decolorized with acidic alcohol for three minutes and counterstained with Methylene blue for one minutes. Finally, the slides were washed with tap water and examined under a microscope.[12] Microscopic examinations were done by experienced clinical laboratory technicians and the determination and verification was made by the investigator. All necessary socio-demographic characteristics such as Age, Sex and HIV positivity and negativity and others was recorded for each participant at the time of enrollment into the study. The recent immune status ($CD4^+$ T-cell counts) of HIV/AIDS infected patients was obtained from their medical records at the study hospitals.

2.5. Ethical Consideration

The study was approved by research committee and ethically cleared by the ethical review committee of Adigrat University, with the reference number of RCS/01/052/2014. Permission and informed written consent was obtained from the hospitals and each study participant, respectively.

2.6. Data Analysis

The collected data was analyzed by SPSS version 20. Univariate logistic regression analysis was used to assess the association between each risk factor and IPIs infection using chi square test. Moreover, to determine the independent risk factors for infection, multiple logistic regression analysis was performed using adjusted odd ratio at 95% Confidence interval. P - value less than 0.05 was considered as statistically significant.

3. RESULT

3.1. Socio-demographic Characteristics

The socio-demographic characteristics of study subjects are displayed in table 1. As indicated, a total of 338 patients (208 female and 130 male) were included in the study. The age of study subjects ranges from 15 - 61 years with the median of 39 years. About 42.3% of study subjects were illiterate and 48.2% of them were married. Among 338 patients, 238 (70.4%) were HIV positive and the remaining 100 (29.6%) were HIV negative patients.

3.2. Prevalence of Intestinal Parasitic Infections

From a total of 338 stool examined for intestinal parasites, 231 (68.34%) were infected with one or more intestinal parasites (Table 2). Among 238 HIV positive and 100 HIV negative patients, 161 (67.6%) and 70 (70%) were infected with one or more intestinal parasites, respectively and there was no statistically significant difference between the two group of study subjects (P > 0.05). In this study, infected individuals were found to harbor one and up to four types of parasites. There were 114 (47.9%) HIV positive patients infected with single parasite infection whereas 47 (19.75%) with multiple parasitic infection and similarly, 49(49%) HIV negative patients were infected with single parasite infection whereas 21(21%) with multiple infection. There was no statistically significant difference in multiple and single infections between HIV positive and HIV negative patients (P > 0.05).

From the detected non opportunistic and opportunistic intestinal parasites, *Entamoeba histolytica* 92 (27.22%) was the most frequently encountered parasite followed by *Cryptosporidium parvum* 53(15.68%), *Gardia lamblia* 43(12.72%), *Ascaris lumbricoides* 31(9.17%), and *Isospora belli* 24(7.1%) and others, respectively (Table 2). *Cryptosporidium parvum* was the most common among opportunistic parasites (15.68 vs. 5%) detected followed by *Isospora belli* (8.8 vs. 3%) and *Cyclospora species* (0.42 vs. 0%) in HIV positive and HIV negative patients, respectively (Table 2). The most frequent non opportunistic intestinal parasites in HIV positive and HIV negative patients were *Entamoeba histolytica* (31.93 vs. 16%) followed by *G.lambia* (13.02 vs. 12%), *Ascaris lumbricoides* (9.2 vs.9%), *Hook worms* (5.9 vs. 6%), *Strongyloides stercoralis* (2.9 vs.1%), *Trichuris trichiura* (4.2 vs.4%) and others parasites, respectively (Table 2).

Table 1:- Socio-demographic characteristics of the study subjects.

Factors	Number of participant (%)		
	HIV positive (238)	HIV negative(100)	Total
Sex **Male** **Female**	76(31.9) 162(68.1)	54(54) 46(46)	130 (38.5) 208 (61.5)
Age **15-30** **31 – 45** **> 45**	72(30.3) 120(50.4) 46(19.3)	45(45) 38(38) 17(17)	117(34.6) 158(46.7) 63(18.6)
Marital status **Single** **Married** **Divorced**	80(33.6) 112(47.1) 46(19.3)	48(48) 61(51) 1(1)	128(37.9) 163(48.2) 47(13.9)
Educational level **Illiterate** **1- 8 grade** **9 -12 grade** **Diploma & abov**e	110(46.2) 84(35.3) 35914.7) 9(3.80	33(33) 23(23) 25(25) 19(19)	143(42.3) 107(31.7) 60(17.8) 28(8.3)
Residence **Urban** **Rural**	165(69.3) 73(30.7)	64(64) 36(36)	229(67.8) 109(32.2)
Occupation **Government employ** **NGO** **Private** **Student** **Farmer** **Others**	12(5) 7(2.9) 48(20.2) 11(4.60 78(32.8) 82(34.5)	15(15) 5(5) 34(34) 25(25) 21(21) 0	27(8) 12(3.6) 82(24.3) 36(10.7) 99(29.3) 82 (24.3)
Eating of raw vegetable **Always** **Sometimes** **Never**	32(13.4) 196(82.4) 10(4.2)	17(17) 71(71) 12(12)	49(14.5) 267(79) 22(6.5)

Proper use of latrine **Yes** **No**	195(81.9) 43(18.1)	79(79) 21(21)	274(81.1) 64(18.9)
Source of drinking water **Tap water** **Protected well** **River**	162(68.1) 62(26.1) 14(5.9)	67(67) 6(6) 27(27)	229(67.8) 68(20.1) 41(12.1)
Total	238(70.4)	100(29.6)	338 (100)

Table- 2: **The distribution of intestinal parasites among HIV positive and HIV negative individuals in Eastern Tigray, Ethiopia, 2015.**

Identified Parasites	HIV (+ve) N= 238(%)	HIV (–ve) N= 100%	Total N= 338(%)	*P-value*
E. histolytica	76(31.93)	16(26)	92(27.21)	0.042
G.lamblia	31(13.02)	12(12)	43(12.72)	0.139
A. lumbricoides	22(9.2)	9(9)	31(9.17)	0.163
T.trichuria	10(4.2)	4(4)	14(4.14)	0.235
S.stercolaris	7(2.9)	1(1)	8(2.36)	0.202
C.parvum	48(20.2)	5(5)	53(15.68)	0.048
I. belli	21(8.8)	3(3)	24(7.1)	0.030
H.worm	14(5.9)	6(6)	20(5.91)	0.197
E. vermicularis	10(4.2)	8(8)	18(5.32)	0.076
Tenia species	5(2.1)	4(4)	9(2.66)	0.168
Paragonimus	3(1.8)	0	3(0.88)	0.348
Cyclospora species	1(0.42%)	0	1(0.29)	0.704
H.nana	1(0.42%)	0	1(0.29)	0.704
Total	161 (67.64)	70(70)	231(68.34)	

The prevalence of both opportunistic and non-opportunistic intestinal parasites was more than one times higher among the HIV positive patients than the HIV negative ones (Odd ratio =2.5, 95% CI= 1.05-5.85). There was no difference in prevalence of *Hookworm*; (6%), *T.trichuria* 4% and *Ascaris lumbricoide* 9%, *E. vermicularis* (5%) and others in both HIV positives and HIV negative patients. However, a higher prevalence of *E. histolytica* (31.93% vs. 16%), and *C.parvum* (20.2% vs. 5%), *Isospora belli* (8.8% vs. 3%) were significantly detected in HIV positive patients than HIV negative patients, respectively (Table 2). Similarly, *G.lamblia* (13.02% vs.12%), *Paragonimus* (1.8% vs.0%), *Strongyloides stercoralis* (2.9% vs.1%) and *Cyclospora* pecies (0.42% vs.0%) were also more prevalent in the HIV infected patients than none infected ones (Table 2).

3.3. Intestinal Parasitic Infections and CD4$^+$ Count of HIV Positive Patients

Out of 238 HIV positive patients studied, 40 (16.8%) patients had severe immunosuppresion (CD4 $^+$ count < 200 cells/ µl), while 107 (45%) patients had moderate (CD4$^+$ count between 201- 499cells/ µl) and 91 (38.2%) light immunosuppresion (CD4 $^+$ count > 500cells/ µl), respectively (Table 3). The detection rate of parasites among HIV positive patients was higher among patients whose CD4 $^+$ count was less than 200cells/ µl than other groups. 70% cases of isolated *C. parvum*, 65% of *E. histolytica*, 57.5% of *G.lamblia* and 32.5% of *Isospora belli* were from these severely immunocompromised patients (Table 3).

4.4. Risk factors associated with Intestinal Parasitic Infections in HIV Positive Patients

In the Univariate regression analysis eating raw vegetables, source of drinking water, age, latrine, marital status, educational level, residence and occupation were greatly associated with different intestinal parasites ($P < 0.05$). According to the multiple regression analysis factors including age, education level, marital status, eating of raw vegetables, occupation, residence and source of drinking water were independently associated with one or more intestinal parasites infection (Table 4). *E. histolytica* **,** *T.trichuria* **,** *S.stercolaris* and *I.belli* were greatly associated with always eating of raw vegetables . Individuals whose age rages 31 – 45 years were more infected to *G.lambia* and *I.belli* than other age groups. Individuals who utilize river as source of dirking water were more infected with *G.lambia* and those who married also were more infected to *C.parvum*. Individuals who live in rural areas and farmers were more vulnerable to *I.belli* and *H.worm* than those live in urban and with other occupations.

Table 3: The distribution of intestinal parasites with respect to CD4 $^{+}$ count of HIV positive patients

Parasites	CD_4^+ count of HIV positive individuals			*Total N=238*	X^2	*P- value*
	<200cell/mm^3 (n = 40)	201-500cell/mm^3 (n = 107)	>501cell/mm^3 (n = 91)			
E. histolytica	26 (65)	26 (24.3)	24 (26.37)	76(31.93)	1.698	0.048
G. lamblia	23(57.5)	5 (4.67)	3(3.29)	31(9.17)	4.353	0.023
A. lumbricoide	8(20)	7(6.54)	7(7.69)	22(9.24)	4.17	0.231
T.trichuria	5(12.5)	2(1.87)	3(3.29)	10(4.20)	0.61	0.439
S.stercolaris	5(12.5)	1(0.93)	1(1.1)	7 (2.94)	0.075	0.508
C.parvum	28 (70)	11 (10.28)	9 (9.89)	48 (20.16)	0.076	0.031
I.belli	13(32.5)	5 (4.67)	3(3.29)	21(8.82)	0.914	0.004
H.worm	3(7.5)	6(5.61)	5(5.49)	14(5.88)	1.38	0.163
E.vermicularis	3(7.5)	4(3.74)	3(3.29)	10(4.20)	2.652	0.379
Tenia species	1(2.5)	1(0.93)	3(3.29)	5(2.10)	0.732	0.352
Paragonimus	1(2.5)	2(1.87)	-	3(1.26)	1.974	0.176
Cyclospora sp	1(2.5)	-	-	1(0.42)	1.622	0.375
H. nana	1(2.5)	-	-	1(0.42)	4.671	1.75

Table 4. Multiple logistic regression analysis for risk factors independently associated with IPIs in HIV positive and negative patients in eastern Tigray, 2015

Parasites	Variables	Odd ratio	*P value*
E.histolytica	**Raw vegetables** Always Sometimes Never	27414191.5(11050259.76- 68010880.74)	0.000
G.lamblia	**Age** 15- 30 31-45 >45	0.289(0.085-0.984) 0.202(0.07-0.584)	0.047 0.003
	Drinking water Tap water Protected well River	23922917132(8612976.711-66446943.06)	0.000
T.trichuria	**Raw vegetables** Always Sometimes Never	39798511.48(5511780.203-287370124.9	0.000
S. stercolaris	**Raw vegetables** Always Sometimes Never	30251751.33(1747371.443-523740079.5	0.000
C.parvum	**Marital status** Single Married divorced	0.324(0.108-0.973)	0.045
I. belli	**Age** 15- 30 31-45 >45	7.316(1.21-44.5)	0.03
	Educational level Illiterate 9 -12 grade Diploma and above	0.033(0.001-0.99)	0.049

	Residence Urban Rural	0.126(0.021-0.747)	
	Occupation Farmer	0.057(0.066-0.516)	0.011
	Raw vegetable Always Sometimes Never	0.066(0.005-0.0909)	0.042
H. worm	**Educational level** Illiterate 9 -12 grade Diploma and above	1.898(1.482-2.422)	0.000
	Residence Urban Rural	10.661(1.579-71.973)	0.015

5. DISCUSSION

The present study was aimed to assess the prevalence of IPIs among HIV positive and HIV negative patients in Eastern Tigray. The overall prevalence of IPIs was 231(68.34%). This result is similar with findings reported in different parts of Ethiopia such as Northern Ethiopia (67.6%) and Central Ethiopia (70%).[14,15], respectively. However, it was higher than the prevalence -reported in South Western Ethiopia (41% and 44 .8%)[16,17] and in Brazil (40%).[18] The possible explanations for discrepancy of IPIs prevalence among studies might be the variation in environmental sanitation practice and personal hygiene of the people.[19] Occupational hazard also be a factor especially among the farmers who have high rate contact with contaminated soil and even the traders who are fond of moistening their fingers with saliva when counting money[16] and sample size of the studies also contribute for the difference.

The prevalence of IPIs among HIV positive and HIV negative patients was 161 (67.64%) and (70%), respectively. This finding is relatively in agreement with the study conducted in Florida, (49%) from HIV sero positive patients whereas (64.6%) from HIV-negative individuals.[20] However, it was inconsistent with result reported in Nigeria, (87.8%) in HIV positive patients and (74%) in HIV negative patients.[21] The possible reason for lower prevalence of IPIs in HIV sero positive patients than HIV sero negative patients in this study might be influenced by HIV enteropathy[22,23] thereby causing both structural and functional impairment of the gut and thus making the environment unfavorable for these parasites to thrive. Increased cytokines production by Helper T cells during HIV replication was also considered to be the contributory factors for the reduction of parasites in the HIV positive patient.[23] Moreover, the sample size and techniques used during diagnosis could be also the possible reasons for the variation observed between the two study groups.

E. histolytica 92(27.21%) was the most prevalent parasites among all the study subjects followed by *C. parvum* 53(15.68%), *G.lamblia* 43(12.72%), *A. lumbricoide* 31(9.17%) and *I.belli* 24(7.1%), respectively. The prevalence of *E.histolytica* in this study is agreement with studies conducted by[15] in Central Ethiopia. However, it was greater than the studies conducted in southern Ethiopia (11.4%)[24] and in Eastern Ethiopia (13.5%).[25] According to this study a significantly higher prevalence of *E. histolytica* was recorded in HIV positive patients as compared with patients without HIV. However, there are studies indicated that higher prevalence of *E. histolytica* was reported in HIV-negative individuals as compared with patients with AIDS.[26,20] The possible variation observed among studies might be associated with frequent consumption of raw vegetables among the study groups. Moreover, according to multiple regression analysis, the occurrence of *E. histolytica* was significantly associated with individuals who consume raw vegetable always.

53(15.68%) was the overall prevalence of *C.parvum* among the current study subjects. The occurrence of this parasite was lower as compared to study conducted in North West Ethiopia (43.6%).[10] However, it was in agreement with studies conducted in Jimma and Addis Ababa which is (17%).[27] Also it was quite higher when compared with results reported in Ivory Cost (7.5%) and Zaire (8%).[28, 29] The variation might be related with the sensitivity of the diagnostic techniques and differences in hygienic practice. Moreover, Oocyst excretion usually variable.[30] According to the multiple regression analysis, marital status of the participants was significantly associated with Cryptosporidiosis infection.

The prevalence of *C. parvum* (20.2 vs 5%) was higher among HIV positive patients than HIV negative patients and its prevalence among the HIV positive in this study was lower as compared to results reported by[31] in southern Ethiopia (34.3%) and in Nigeria (32.2%).[21]

The possible reason might be due to difference in immunity status, diarrheic status, environmental and personal hygiene of the study participants. Similarly, higher prevalence of *I.belli* 21(8.8%) was also detected among HIV positive patient. The occurrence of *I.belli* in this study was lower than results reported in Ethiopia (15.5%), Tanzania (11.6%) and Zaire (12%)[10, 28, 32], respectively. However, it was higher as compared to reports from Gonder (2.4%) and Addis Ababa (1.4%).[27, 33] The variation might be associated with differences with antiretroviral treatments, hygienic condition and source of water of the study participants. Moreover, according to multivariate regression analysis, infection of *I.belli* is significantly associated with study variable such as age, educational level, residence occupation and consumption of raw vegetables. The frequencies of opportunistic parasites are greatly associated with increasing duodenal mucosa damage. Unimpeded rates of intracellular parasite establishment and/or survival may result in higher prevalence in HIV-infected individuals with enteropathy when compared with persons not infected with the virus.

The occurrence of *G. lamblia* 43 (12.72%) in this study was inconsistent with the study conducted by[24] in Southern Ethiopia. However, it was higher than the study reported among non-school children (3.2%).[34] According to the multiple regression analysis, giardiasis was significantly associated with the source of drinking water and this is in agreement with studies conducted by[35] Moreover,[36] and[37] revealed that giardia cysts have been also isolated from water supplies in different parts of the world.

The occurrence of *G.lambila* and other non opportunistic parasites were not show significant difference between the HIV infected and non infected patients but according to different reports the non opportunistic parasites were observed greatly in HIV negative patients. This could be gut of HIV-infected individuals may not be a favorable environment for the establishment and or survival of extracellular parasites, intracellular and mucosal dwelling organisms may not be adversely affected by the pathologic changes.[39]

In the present study, HIV positive patients with CD4 + count less than 200cells/µl were significantly susceptible to *C. parvum* and *I.belli* and this finding is in line with different studies conducted in Ethiopia[27,9] and also in Nigeria.[39,40] This might be indicating that T lymphocytes are involved in the immune response to the co-infection (HIV infection and opportunistic parasites); although a decrease of immunity level was observed with the HIV infection. The mechanism needs further study in the future, since immunity has a key role in T lymphocyte proliferation and activity and is fundamental to a human protective immune response.[38]

6. CONCLUSION AND RECOMMENDATION

The present study confirmed that high prevalence of opportunistic and non opportunistic intestinal parasites were encountered among the study subjects. Among detected intestinal parasites, *E. histolytica* was the most prevalent parasites followed by *C. parvum*, *G.lamblia*, *A. lumbricoide* and *I.belli*, respectively between the study groups. *C. parvum* and *I. belli* were the most detected opportunistic parasites among HIV +Ve patients. Moreover, HIV +Ve patients with CD_4^+ count < 200cells/ µl were highly infected with the coccidian parasites. Therefore, researcher recommended that periodical detection and treatment of coccidian parasites are vital to assure the life quality of the HIV infected patients. Moreover, concerned bodies should be provided education programs to the rural communities to keep their environmental sanitation and personal hygiene against intestinal parasites.

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