Intestinal Parasites among HIV-infected Patients at Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife

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Abstract

Background: Intestinal parasites are a cause of morbidity and mortality throughout the world particularly in HIV-infected patients. This study determined the prevalence of intestinal parasites among HIV-infected patients, assessed risk factors predisposing to infection and also assessed association of intestinal parasites with the CD4 counts of the patients. **Materials and Methods:** It was a cross sectional study and 226 HIV-infected patients attending the Virology Research Clinic of OAUTHC were recruited. Questionnaires were administered to obtain relevant demographic information. Stool samples were collected and examined. Data processing was done using SPSS Inc USA version 17. Statistical analysis was done using frequency, proportion, percentages, tables and Pearson's chi-square was used to determine the association between intestinal parasites and risk factors. **Results:** The overall prevalence of intestinal parasites in this study is 15.4%. *Cryptosporidium sp*. and *Ascaris lumbricoides* had the highest prevalence, both had rates of 4.4% followed by *Entamoeba histolytica* with a rate of 3.1%. *Cyclospora sp*. had a rate of 1.8%, *Strongyloides stercoralis* had a rate of 0.9% while *Entamoeba coli* and hookworm both had rates of 0.4%. Co-existence of *Cryptosporidium* with *Strongyloides stercoralis* occurred in one of the HIV-infected patients. Exposure to goats and dogs was found to be significantly associated with intestinal parasites. The CD4 count was not significantly associated with presence of intestinal parasites. **Conclusion:** Intestinal parasites are still prevalent among HIV-infected patients and exposure to dogs and goats was a risk factor. There was no association between intestinal parasites and CD4 counts of the patients.

Keywords: HIV-infected patients, intestinal parasites, risk factors

Introduction

Intestinal parasites, some of which constitute the neglected tropical diseases, are a cause of morbidity and mortality throughout the world particularly in developing countries. This is associated with poor sanitation, lack of access to portable water, inadequate health facilities, and poverty.[1] Globally, the HIV/AIDS pandemic is a major public health challenge. An estimated 33.0 (30.3–36.2) million adults and children are living with the virus worldwide, and Sub-Saharan Africa is one of the regions that has been adversely affected by this pandemic; with an estimated 22 (20.5–23.6) million adults and children living with the virus.[2] Immunosuppression in HIV-infected patients predisposes them to various microbial and parasitic infections.[3] Opportunistic infections also thrive in HIV-infected patients as a result of the immunosuppression, and this adversely affects the quality of life of these patients. The intestinal protozoa *Cryptosporidium, Cyclospora*, and *Isospora* cause prolonged diarrhoea in these patients which is particularly debilitating.[4] *Cryptosporidium* has been a major etiologic cause of diarrhea in HIV/AIDS patients, and cryptosporidiosis has become one of the AIDS-defining opportunistic infections.[5] HIV-related chronic diarrhoea has a multifactorial etiopathogenesis, and enteric parasites are known to play a prominent role in the incidences.[6]

The presence of intestinal parasites in HIV-infected patients further compounds the immunosuppression, and investigating these infections will provide useful data which will enhance the management of these patients and improve their quality

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of life. This study sought to determine the prevalence of intestinal parasitic infections among HIV-infected patients, the risk factors predisposing these patients to these infections, and the association of these infections with the CD4 counts of the patients.

Materials and Methods

Subjects

This study was conducted at the Department of Medical Microbiology and Parasitology, Obafemi Awolowo University (OAU), Ile-Ife, Osun State, Nigeria. Approval for the study was obtained from the research and ethical committee of OAU Teaching Hospitals Complex (OAUTHC), Ile-Ife, and informed consent was obtained from the individuals. The individuals were adult HIV-infected patients attending the Virology Research Clinic of OAUTHC, Ile-Ife, and 226 participants were randomly selected. Consenting adult HIV-positive patients attending the HIV clinic, OAUTHC Ile-Ife were included in the study while children that are HIV-positive, adult diabetic patients and adult patients on cytotoxic or immunosuppressive therapy were excluded.

Demographic information

With the aid of a semistructured questionnaire, relevant demographic information was obtained from the individuals who satisfied the inclusion criteria. The questionnaire was used to assess the socioeconomic status of the patients. Questions on housing structure, occupation, water supply, toilet facilities, and contact with animals were included.

Sample collection and parasite detection

Stool samples were collected from each participant that has been diagnosed as HIV-infected into clean dry universal bottles and were transported promptly to the laboratory. Direct smear samples of the stool were made with both saline and iodine mounts on clean grease-free slides and examined under the microscope, first with × 10 and then × 40 objectives, for ova and cysts of parasites. The stool samples were concentrated using the formol-ether concentration method. Detection of *Cryptosporidium*, *Cyclospora*, *and Isospora* oocysts in the concentrated stool was done using the modified Ziehl–Neelsen staining technique.

Statistical analysis

Data entry and processing were done using the SPSS version 17 computer software. Statistical analysis was done using frequency, proportion, percentages, and tables and Pearson's Chi-square was used to determine the association between intestinal parasites and risk factors. $P \leq 0.05$ were taken to be significant.

Results

Two hundred and twenty six adult HIV-infected patients participated in the study, of which 39 (17.3%) were males and 187 (82.7%) were females. The age range of the study population was 18–70 years and the mean age of the study population is 40.9 ± 10.6 years. The age group 29–39 years had the highest prevalence of intestinal parasites as shown in Table 1.

Table 1: Distribution of intestinal parasites with respect to age and gender

Characteristics	With intestinal parasites (*n*=32)	Without intestinal parasites (*n*=194)	*P*	OR	CI
Sex					
Male	8 (25)	31	0.3179	1.75	0.62-4.50
Female	24 (75)	163			
Age (mean)	39.72	41.08	0.4654		
Age range					
18-28	2	17	0.896	0.69	0.07-3.18
29-39	15	83	0.810	1.096	0.73-1.64
40-50	10	57	0.996	1.064	0.61-1.86
51-61	4	26	1.000	0.92	0.22-2.96
62-72	1	11	0.865	0.551	0.07-4.12

$P<0.05$ is statistically significant. OR: Odd's ratio, CI: Confidence interval

Table 2: Prevalence and distribution of intestinal parasites among the participants

Intestinal parasites	Frequency, *n* (%)
Cryptosporidium sp.	10 (4.4)
Ascaris lumbricoides	10 (4.4)
Cyclospora sp.	4 (1.8)
Hookworm	1 (0.4)
Entamoeba histolytica	7 (3.1)
Entamoeba coli	1 (0.4)
Strongyloides stercoralis	2 (0.9)
Total	35 (15.4)

The overall prevalence of intestinal parasites in this study was 15.4%. *Cryptosporidium* sp. and *Ascaris lumbricoides* had the highest prevalence; both had rates of 4.4% followed by *Entamoeba histolytica* with a rate of 3.1%. *Cyclospora* sp. had a rate of 1.8%, *Strongyloides stercoralis* had a rate of 0.9%, while *Entamoeba coli* and hookworm both had rates of 0.4%. Coexistence of *Cryptosporidium* with *Strongyloides stercoralis* occurred in one of the HIV-infected patients. This is shown in Table 2.

Table 3 shows the factors investigated and their association with cryptosporidiosis. Out of the factors, exposure to dogs and goats was found to be significantly associated with infection with intestinal parasites (P = 0.042 and 0.043, respectively).

The study population was categorized into two groups based on the CD4 count (<200 cells/mm^3 and >200 cells/mm^3) The CD4 count was not found to be significantly associated with intestinal parasitosis (P = 0.706). This is shown in Table 4.

The overall prevalence of intestinal parasites in this study was 15.4%. *Cryptosporidium* sp. and *Ascaris lumbricoides* had the highest prevalence; both had rates of 4.4% followed

Table 3: Factors predisposing to intestinal parasite infection among the participants

Factors	With intestinal parasites (*n*=32)	Without intestinal parasites (*n*=194)	*P*	OR	95%CI
Toilet facilities					
Bush	3 (0.9)	16 (0.8)	1.000	1.15	0.20-4.39
Pit	18	88	0.253	1.240	0.88-1.75
Shot put	1	9	1.000	0.66	0.01-5.09
Water closet	10	81	0.262	0.62	0.25-1.49
Water supply					
Bottled	0	2	1.000	0.00	0.00-32.62
Sachet	1	9	1.000	0.66	0.01-5.09
Rain	2	8	0.637	1.55	0.15-8.28
Spring	0	1	1.000	0.00	0.00-236.437
Stream	2	9	0.658	1.000	0.14-7.09
Tap	2	12	1.000	1.000	0.10-4.90
Well	25	153	0.925	0.96	0.37-2.81
Occupation					
Artisan	10	38	0.1992	0.96	0.37-2.81
Clergyman	0	2	1.000	0.00	0.00-32.62
Civil servant	6	29	0.5972	1.31	0.41-3.65
Farming	1	8	1.000	1.000	0.02-5.94
Retiree	1	4	1.000	1.53	0.03-16.13
Student	0	4	1.000	0.00	0.0000-9.3493
Trading	13	104	0.173	0.59	0.25-1.35
Pets					
Dog	8	21	0.026*	2.75	0.94-7.35
Goat	14	51	0.043*	2.18	0.93-5.10
Cat	0	0	ND		
Chicken	13	85	0.736	0.88	0.38-2.00
Turkey	0	4	1.000	0.00	0.0000-9.3493

*$P<0.05$ is statistically significant. OR: Odd's ratio, CI: Confidence interval, ND: Not determined

Table 4: Association between CD4 count/antiretroviral therapy and intestinal parasites

Factors	With intestinal parasites (*n*=32)	Without intestinal parasites (*n*=194)	*P*	OR	95%CI
CD4 count					
<200 (cells/mm^3)	4	35	0.606	0.65	0.16-2.03
>200 (cell/mm^3)	25	146			
ART					
With ART	25	162	0.457	0.71	0.27-2.10
Without ART	7	32			

$P<0.05$[18] is statistically significant, χ^2: Pearson's Chi-square test. CI: Confidence interval, ART: Antiretroviral therapy, OR: Odd's ratio

by *Entamoeba histolytica* with a rate of 3.1%. *Cyclospora sp*. had a rate of 1.8%, *Strongyloides stercoralis* had a rate of 0.9%, while *Entamoeba coli* and hookworm both had rates of 0.4%. Coexistence of *Cryptosporidium* with *Strongyloides stercoralis* occurred in one of the HIV-infected patients. This is shown in Table 2.

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The study population was categorized into two groups based on the CD4 count (<200 cells/mm^3 and >200 cells/mm^3). The CD4 count was not found to be significantly associated with intestinal parasitosis (P = 0.706). This is shown in Table 4.

Discussion

The study population consisted of 226 HIV-infected patients, of which 39 (17.3%) were males and 187 (82.7%) were females. The mean age of the study population is 40.9 ± 10.6 years. Gender and age were not found to be significantly associated with the presence of intestinal parasites in the HIV-infected patients.

An overall prevalence of 15.4% of intestinal parasites was obtained in this study. The prevalence rates of intestinal parasites vary among HIV-infected patients in different geographical locations. The rate obtained in this study is consistent with the report of Akinbo *et al*.,[1] in Benin, Nigeria, where a prevalence rate of 15.3% was recorded. In Kano, Nigeria, Jegede *et al*.[4] reported a prevalence of 11.4%. However, some studies carried out in Africa recorded quite high prevalence rates[3,5] of 59.5% and 50.9% in West Cameroon and Kenya, respectively. This could be due to differences in the population used for the studies; most of the individuals reside in areas that do not have access to portable water and health facilities.

The most prevalent intestinal parasites in this study are *Ascaris lumbricoides* and *Cryptosporidium* sp.; both had rates of 4.4% each. This is in accordance with the findings of Akinbo *et al*.[1] and Adeleke *et al*.[7] in Benin, Nigeria and South Africa, respectively, who reported *Ascaris lumbricoides* as the most prevalent intestinal parasite in their studies. Cryptosporidiosis is a disease caused by the coccidian parasite *Cryptosporidium* sp., a minute protozoal organism, and the disease has been of increasing interest due to its opportunistic potential in immunocompromised patients, particularly in those with HIV/AIDS.[8] Cryptosporidial infection causes a lot of clinical problems which are increasingly becoming recognized internationally to the extent that the infection was included in the World Health Organization's neglected diseases initiative 2004.[9] The prevalence of *Cryptosporidium* obtained in this study is in agreement with studies[10,11] in various other centers with prevalence rates of 3.9% and 5.7%, respectively, but lower than what was obtained in a study carried out in West Cameroon[3] where a rate of 19.04% was obtained. The other intestinal parasites obtained in this study include *Entamoeba histolytica* with a rate of 3.1%. *Cyclospora* sp. had a rate of 1.8%. *Cyclospora* is another opportunistic protozoal parasite and the prevalence obtained in this study is similar to the findings of Paboriboune *et al.*[12] that reported a rate of 2.2%. *Strongyloides stercoralis* had a rate of 0.9% while *Entamoeba coli* and hookworm both had rates of 0.4%. Coexistence of *Cryptosporidium* with *Strongyloides stercoralis* occurred in one of the HIV-infected patients.

A number of factors were investigated in this study to determine their association with intestinal parasites in the study participants. It is interesting to note that out of all the factors that were assessed, exposure to dogs ($P = 0.042$) and goats ($P = 0.043$) was found to be significantly associated with the presence of intestinal parasites. This further establishes the fact that some of these intestinal parasites can be transmitted zoonotically, especially with the opportunistic protozoal organisms. This is supported by studies carried out by Pedraza-Díaz *et al.*[13] and Shukla *et al*.[14] *Cryptosporidium* sp. oocysts and *Entamoeba histolytica* cysts have been found to be excreted in the environment by dogs, and these can be transmitted to humans through close contact with these animals and the contaminated environment.[15]

The association between intestinal parasites and CD4 count was also evaluated in this study. It was however surprising that intestinal parasites were not found to be significantly associated with low CD4 counts as reported by some studies.[16] Similarly, low CD4 counts as obtained in this study has been found not to be a risk factor for intestinal parasitic infection in a report from Kenya.[17]

In conclusion, intestinal parasites are still prevalent among HIV-infected patients, and exposure to dogs and goats was a risk factor. There was no association between intestinal parasites and CD4 counts of the patients. Patients need to be educated to wash their hands before and after contact with these domestic animals. Further studies are needed to examine the stool samples of the implicated pets (dogs and goats) to ascertain whether they are infected with these intestinal protozoal parasites.

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Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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Conflicts of interest

There are no conflicts of interest.

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