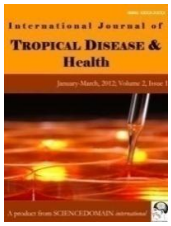

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Gastrointestinal Helminth Infections in HIV Seropositive and Seronegative Patients in Dschang, Cameroon

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MTCG, WPJ and MM designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author MTCG managed the analyses of the study and the literature searches. Author FF helped to the collection of blood. All authors read and approved the final manuscript

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ABSTRACT

Background: Helminth infections are widely spread around the world and constitute a major public health problem. They present one of the most common parasitic infections worldwide with a greater proportion occurring in the less developed areas of the world like Sub-Saharan Africa. This area has the highest regional prevalence of Human Immunodeficiency Virus (HIV) in the world. Due to the overlapping geographical distribution of these infections, coinfection between helminths and HIV are likely to be common. Little has been reported on the relationship between HIV status and the presence of these parasites in Dschang.
Aim: This study was undertaken to determine and compare prevalence and intensity of helminth infections between Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome (HIV/AIDS) infected (seropositives) or non infected (seronegatives) patients.

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Methods: Patients were recruited using the registration number at their arrival in the District and Saint Vincent de Paul hospitals of Dschang. For each subject, stool and blood samples were collected. Qualitative and quantitative analysis of stool samples were carried out using Willis and McMaster techniques respectively. As for serological analysis of HIV/AIDS, the test was done using DETERMINE HIV1/HIV2 rapid test and IMMUNOCOMB test for confirmation.
Results: Five hundred and seventy (570) patients were recruited following inclusion criteria. One hundred and seven (107) were seropositives and four hundred and sixty three (463) seronegatives. The overall prevalence of helminthic infections was 23.11%. *Ascaris lumbricoides, Trichuris trichiura, hookworm* and *Capillaria hepatica* were found with respective prevalences of 10.9%, 6.8%, 3.2% and 0.2%. The general prevalences were 10.28% and 20.73% for HIV seropositives and seronegatives respectively. The mean intensities of infection were 182.25±566.12, 130.95±153.79, 91.66±104.67 and 50±0.00 epg for *A. lumbricoides, T. trichiura, hookworm* and *C. hepatica* respectively. In seropositives, these values were 50±0.00, 68.75±88.30, 50±0.00 and 0±0.00 epg while in seronegatives; they were 282.41±831.46, 145.59±167.59, 94.11±107.35 and 50±0.00 epg for *A. lumbricoides, T. trichiura, hookworm* and *C. hepatica,* respectively. Seropositives were statistically significant ($p<0.05$) less infected with helminths than seronegatives. Elsewhere, the mean intensities of infection were lower in seropositives than in seronegatives.
Conclusion: The prevalence and parasite loads are fewer in seropositives than in seronegatives. Therefore, harboring HIV is not associated with increasing in helminths prevalence.

Keywords: Helminths, epidemiological data, seropositives, seronegatives, Dschang, Cameroon.

1. INTRODUCTION

Soil transmitted helminth infections affect over a billion individuals worldwide with the highest prevalences occurring in developing countries [1]. They are described as neglected tropical diseases, but constitute a major public health problem. The presence of individuals infected with intestinal parasites in situation of poverty, lack or poor use of latrines, overcrowding and soil characteristics provide the conditions for the maintenance and transmission of such infections [2]. World Health Organisation (WHO) estimated that at least 2 billion people in the world suffer from helminthiasis, and of those, approximately 300 million suffer associated severe morbidity [3]. Sub Saharan Africa, a region of intestinal helminth endemicity in rural and urban settings [4] is burdened by infection with Human Immunodeficiency Virus (HIV) with an estimated 70% of the world's cases [5]. Thus, the geographical distributions of these pathogens overlap extensively and coinfection HIV with helminths becomes common in Africa [6]. Many studies have been conducted around the world concerning this subject and varying results were obtained [7-11]. There have been few studies to ascertain whether epidemiology of gastrointestinal helminths takes different pictures as population with Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome (HIV/AIDS) is growing in Dschang. This study was therefore undertaken to determine and compare prevalence and intensity of helminth infections between HIV/AIDS infected (seropositives) or non infected (seronegatives) patients. The development of baseline data on the prevalence of these parasites in each group may help evaluate the relationship between HIV status and the presence of gastrointestinal helminths in Dschang.

2. MATERIALS AND METHODS

2.1 Study Design, Period and Area

A prospective, comparative cross-sectional study was conducted in Dschang from October 2012 to August 2013. Dschang is situated in the Menoua Division, Western Region of Cameroon. The altitude is about 1382-1500 m above sea level. This town is between 5°20"-5°28" latitude North and between 10°3"-10°6" longitude East. The climate is soudano-guinean with two seasons: a dry season which runs from mid-November to mid-March and a rainy season from mid-March to mid-November. Temperature varies between 15.4°C and 25°C, relative humidity from 64.3% to 97% and rainfall between 0.4 and 50 mm. According to the 2010 population and housing census, Dschang had a population of 120207. Among these, 56708 were males and 63499 females. The principal occupations are trading and agriculture. The population gets its portable water from tap or from natural sources be it protected or not. The health of the population is principally assured by two main hospitals namely

Saint Vincent de Paul and district hospitals where our study was conducted.

2.2 Ethical Considerations

Study procedures were reviewed and approved by the Cameroon Bioethics Initiative. Permission to conduct the study was also obtained from the authorities of the Saint de Paul and District hospitals. The study was briefly explained to the participants and they were assured of the confidentiality as well as anonymity of the collected information. Participation was fully voluntary and interested individuals provided informed written consent. In the case of children, assent was granted by parents or legal guardians before enrolment into the study.

2.3 Exclusion and Inclusion Criteria

Participants who had less than 15 years old or who refused to sign the inform consent were excluded from the study. Those who had 15 years and above, suffer from abdominal pains and not received anthelminthic drugs for at least 3 weeks were included in the study.

2.4 Data Collection and Processing

A structured questionnaire was administered to all participants. The data was collected on the age, sex, marital status and sanitation habits. Stool and blood samples were collected from each participant. To collect the later, each participant received a sterilized label plastic container (with an identification code). The stool specimens were collected between 8 am and 12 am in order to take the first feces of the day since they are more concentrated in eggs. Also, this period was our daily study period .These specimen preserved in 10% formalin, transported to the Laboratory of Applied Biology and Ecology (LABEA) of the University of Dschang for microscopically analysis. In the laboratory, stools were analyzed using the Willis concentration technique for the detection of the helminth ova. The Willis or Flotation technique is a qualitative test for the detection of nematode eggs by separating eggs from faecal material and concentrating it with a flotation fluid. Also, the intensity of infection was carried out according to McMaster technique [12]. It is a quantitative test for demonstrating and counting helminth eggs in faecal samples. For the blood collection, five (5) milliliters was collected by vein junction of each patient into an EDTA bottle. Plasma were tested for HIV infection by DETERMINE HIV1/HIV2 rapid test and confirmed by IMMUNOCOMB II test. According to Amadou et al. [13] in Niger, IMMUNOCOMB II has a specificity and sensitivity of 100%.

2.5 Statistical Analysis

Data were entered into Microsoft Excel and statistical analysis was performed by SPSS (Statistical Package for Social Sciences) Version 19.0. The sex distribution and prevalence of HIV positives and HIV negatives were compared using chi-square analysis, while the means ages and intensities of infection were compared by Mann-Whitney non-parametric test. A p-value of <0.05 was considered statistically significant.

3. RESULTS

3.1 Demographic Information

Overall, 570 participants were enrolled into the study among which 144 (25.3%) were males and 426 (74.4%) females; the mean (± SD) age was 34.5 (±16.5) years (range 15-85).

3.2 HIV Status in the Study Population

There were 107 HIV positives and 463 HIV negatives. The HIV positives comprised 32 (29.9%) males and 75 (70.1%) females with a mean (± SD) of 38.1 (±13.5) years. Among HIV negatives, 112 (24.2%) were males and 351 (75.8%) were females with a mean (± SD) age of 33.6 (±17) years.

3.3 Prevalence of Helminths Infection in the Study Population

Of the 570 participants screened, 107 (23.11%) were infected with at least one type of gastrointestinal helminth, in which 31(29%) were males and 76 (71%) were females. The infection rates according to sex of patients in each group are illustrated in Table 1. No significant difference ($p> 0.05$) was observed between infection rate of any sex and HIV serostatus.

3.4 Helminths Identified

Four types of gastrointestinal helminths were identified: *Ascaris lumbricoides* (10.9%), *Trichuris trichiura* (6.8%), hookworm (3.2%) and *Capillaria hepatica* (0.2%). These helminths were found in 10.28% (11 of 107) of the stool samples from HIV-seropositive subjects compared with

20.73% (96 of 463) of those from HIV-negative participants. The prevalence was lower in HIV-positive individuals than that in HIV-negative subjects (p=0.013).

The distribution of helminths detected in the population is shown in Table 2.

The prevalence of infection by *A. lumbricoides*, *T. trichiura* and hookworm in HIV positives were 7.48% (8 of 107), 4.67% (5 of 107) and 0.93% (1 of 107) respectively. These numbers were 11.66% (54 of 463), 7.34% (34 of 463), 3.67% (17 of 463) and 0.21% (1 of 463) for *A. lumbricoides*, *T. trichiura*, hookworm and *C. hepatica* respectively in HIV negative patients. No significant difference (P>0.05) was observed between the prevalence of gastrointestinal helminths and HIV serostatus of the patients. *C. hepatica* infection was found only among HIV negatives.

3.5 Parasitic Combination in HIV-Negative and HIV-Positive Patients

The prevalence of infection by the type of parasitic combination is 90.6% in HIV-positive patients and 91.2% in HIV-negative patients for monospecific parasitism. For bispecific parasitism, these values were to closer 8.4% and 8.3% for the two groups of patients respectively.

3.6 Parasitic Load

The parasitic burden in HIV positives and HIV negatives is illustrated in Table 3.

Overall, *A. lumbricoides* (182.25±566.12 epg) showed the highest parasitic mean intensity in term of egg per gram (epg) of feces followed by *T. trichiura* (130.95±153.79 epg), hookworm (91.66±104.67 epg) and *C. hepatica* (50 epg). The entire 107 parasite-infected individuals had light-intensity infection for *A. lumbricoides* (<5000 epg), *T. trichiura*, hookworm (<2000 epg) and *C. hepatica*. The mean intensity of infection was higher in HIV negative patients as concern all the nematodes identified. The differences between these parasitic intensity values according to the HIV status were statistically significant (p<0.05). The general informations of the population understudied is shown in Table 4.

Table 1. Infection rates according to sex in each group of the study

Sex	HIV-positive			HIV-negative		
	Number examined	Number infected	Prevalence (%)	Number examined	Number infected	Prevalence (%)
Female	75	5	6.66	351	71	20.23
Male	32	6	18.75	112	25	23.32
Total	107	11	10.28*	463	96	20.73*

**=significant difference*

Table 2. Distribution of gastrointestinal helminths in HIV-positive and HIV-negative subjects

Helminths	HIV-positive (n=107) (%)	HIV-negative (n=463) (%)	Total (n=570) (%)
Ascaris lumbricoides	8(7.48)	54(11.66)	62(10.88)
Trichuris trichiura	5(4.67)	34(7.34)	39(6.84)
Hookworm	1(0.93)	17(3.67)	18(3.16)
Capillaria hepatica	0	1(0.21)	1(0.17)

Table 3. Helminth fecal egg counts in HIV-positive and HIV-negative patients from Dschang District Hospital and Saint Vincent de Paul Hospital

Helminths	HIV-positive (n=107)	HIV-negative (n=463)	p-value
Ascaris lumbricoides	50±0.00	282.41±831	0.000
Trichuris trichiura	68.75±88.30	145.59±167.59	0.000
Hookworm	50±0.00	94.11±107.35	0.000
Capillaria hepatica	0±0.00	50±0.00	0.000

Table 4. Informations of the population understudied

Variable	Total population n (%)	HIV-negative n (%)	HIV-positive n (%)
Sex			
Male	144(25.26)	112(77.78)	32(22.22)
Female	426(74.74)	351(82.39)	75(17.61)
Mean age (years)	34.5	33.6	38.1
Level of education			
Illetrate	32(5.61)	30(6.48)	2(1.87)
Primary	59(10.35)	51(11.01)	8(7.48)
Secondary	371(65.09)	276(59.61)	95(88.78)
Higher	108(18.95)	106(22.89)	2(1.87)
Occupation			
Student	189(33.15)	175(37.90)	14(13.08)
Farmer	73(12.81)	57(12.31)	9(8.41)
Employed	115(20.17)	83(17.93)	32(29.91)
Unemployed	7(1.23)	4(0.86)	3(2.80)
Housewife	180(31.58)	140(30.24)	40(37.38)
Pensioner	6(1.05)	4(0.86)	2(1.87)
Personal hygiene			
Washing hand before meals			
Always	41(7.19)	21(4.53)	20(18.69)
Sometimes	526(92.98)	440(95.03)	86(80.37)
Never	3(0.53)	2(0.44)	1(0.93)
Wearing shoes when working in the farm			
Yes	462(81.05)	376(81.21)	86(80.73)
No	68(11.93)	57(12.31)	11(10.28)
None	40(7.02)	30(6.48)	10(9.34)
Source of drinking water			
Boring	22(3.86)	16(3.45)	6(5.61)
Well	16(2.81)	11(2.38)	5(4.67)
Source	275(48.24)	235(41.23)	40(37.38)
Tap	253(44.38)	198(42.76)	55(51.40)
Many	4(0.70)	3(0.63)	1(0.93)

4. DISCUSSION

This study determined the prevalence and pattern of gastrointestinal helminths among HIV-positive and -negative individuals. The study also attempted to investigate whether the distribution of these parasites was affected by immune status. This study showed an overall prevalence of gastrointestinal helminths of 23.11%. This prevalence is close to that reported in India by Okodua et al. [14] (19.5%) in 2003 and Modjarrad et al. [15] in Zambia. It is higher than those reported in Nigeria (11.5%) and China (4.5%) [11,16]. The reason for these differences could be as a result of environmental and behavioral pattern of the people in these regions. However, this overall prevalence is relatively low when compared to that recorded by Wabo Poné et al. [17] (41.5%) in Dschang. This could be due to the changes in the sanitary habits of the population during years, a factor confirmed by laboratory staff.

The repertoire of gastrointestinal helminths that we recorded was relatively similar to the findings of other surveys [10,11,14,17]. The most prevalent nematode was *A. lumbricoides* (10.9%) followed by *T. trichiura* (6.8%) and hookworm (3.2%). These values are relatively low as that observed in Dschang and in San Pedro [10,17]. The low species-specific rates recorded in this study may be due to public awareness and improvement of environmental sanitation.

HIV positive patients were infected by *A. lumbricoides*, *T. trichiura* and hookworm at a rate of 7.48% , 4.67% and 0.93%, respectively, with no significant difference ($p>0.05$) between prevalence of infection with any of these gastrointestinal helminths and HIV serostatus. This observation is consistent with that of

Babatunde in Nigeria [7]. The rate of infection in HIV positives was significantly low ($P<0.05$) than in seronegatives. Similar observations were obtained in other studies in Nigeria, San Pedro, Ethiopia and Haiti [7,8,10,18]. Conversely, Inabo et al. in 2012 found that the rate of infection was low in HIV negatives than in HIV positives in Nigeria. Tian et al. [11] recorded in China that there was no significant difference in the infection rate in these two groups. The lower prevalence in HIV positives may be due to loss of infection[11]. It has been postulated that the colonization of the intestinal tract by parasites might have been influenced by HIV enteropathy, thereby causing both structural and functional impairment of the gut and, thus making the luminal environment unfavorable for these parasites to thrive [19,20]. Increased cytokines production by Helper T cells (Th2) during HIV replication was also considered contributory to reducing parasites survival in the HIV- positive patient's gut [20].

Ascaris lumbricoides showed the highest parasitic-mean intensity in the whole population (182.25±566.12 epg). In fact, *Ascaris* has a higher egg output (200.000 egg per day) compared to *Trichuris* and hookworm. *Capillaria hepatica* showed the lowest parasitic mean intensity (50 epg). This can be due to the fact that *C. hepatica* is an exceptionally rare infection in humans and both worms and eggs could not be easily detected in peripheral blood and stool of infected hosts and the cornerstone of diagnosis remains the liver biopsy [21-22]. The mean parasitic intensity for each nematode obtained in this work was lower to that obtained by Wabo Poné et al. [17]. A reason could be that since these patients are coming to clinic as a result of their illness, some of them would have been on chemotherapy.

One hundred percent (100%) infections were light-intensity infection for each parasite in the whole population as well as in each group. These findings do not agree with those of Modjarrad et al. [15] who reported 79.7% of light intensity infections for *A. lumbricoides*, hookworm and *Schistosoma mansoni*. This difference can be explained by the different methods used since Modjarrah et al. [22] used Kato Katz technique which is more sensitive than McMaster. Intensities of infection were significantly less in HIV seropositives than in HIV negatives individuals. This may be due to the fact that levels of the Th2 cytokines IL 4 and IL 10 have been found to be higher in HIV infected patient both with and without opportunistic infections, than in uninfected controls.

5. CONCLUSION

Although our study was limited by the number of stool samples analyzed per person, HIV-positive individuals were found to be less likely to have gastrointestinal helminths than those who were HIV-negative.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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