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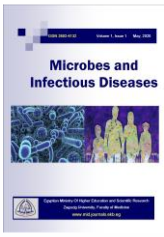

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Original article

Prevalence of intestinal helminths among HIV patients accessing healthcare services at Faith Alive Foundation, Jos, Nigeria

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ABSTRACT

Background: Intestinal helminth infections in human immunodeficiency virus (HIV)-positive individuals have been widely reported to play an important role in HIV progression. **Aim:** The study provides data on the prevalence of intestinal helminths among HIV-positive individuals. **Methods:** A total of 169 consenting HIV-positive individuals were recruited for the study. Stool specimens from the HIV-positive individuals were analyzed for the presence of intestinal helminths using wet mount and formalin-ether concentration methods. **Results:** The overall prevalence of infection was 21.9% with 5 types of parasites detected. The Intestinal helminth that occurred with the highest prevalence was *Ascaris lumbricoides* (37.8%), followed by Hookworm (16.2%), *Taenia* spp. (16.2%) and *Strongyloides stercoralis* (13.5%) with *Trichuris trichiura* (8.1%) being the least prevalent. However, there was more single (91.9%) than mixed infections (8.1 %). Concerning socio-demographic factors, there was no significant association ($p > 0.05$) between intestinal helminths and gender (X^2 (1, N = 169) = 1.239, $p = 0.266$), although, the parasites were found to be more prevalent among males than females. Infection was reported in 16.1% of those on highly active antiretroviral therapy (HAART) and 53.8% of those that were HAART-naïve indicating that there was a significant association (X^2 (1, N = 169) = 18.346, $p = 0.001$**) between intestinal helminth and HAART status. **Conclusions:** This study reported a low burden of intestinal helminths among HIV-infected individuals on HAART while a higher burden was recorded in the HAART naïve patients. Regular check-up for intestinal parasites, good personal hygiene, and effective therapy for HIV/AIDS positive persons is hereby advocated.

Introduction

The human immunodeficiency virus (HIV) infection has remained a source of continued concern to global health and wellness. Human immunodeficiency virus has reportedly been implicated in changing the epidemiologic landscape and pattern of opportunistic parasitism involved in major morbidity globally [1]. Almost 24% of the global population has infections caused by intestinal helminths, with a high prevalence in the underdeveloped and poor nations in tropical and subtropical regions, sub-Saharan Africa inclusive which is also a major cause of death, especially in immunocompromised patients [2,3]. The most significant intestinal helminths are the soil-

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transmitted helminths (STHs), such as *Ascaris lumbricoides, Trichuris trichiura, Strongyloides stercoralis* and hookworms [4].

Intestinal parasitic infections reported as the hallmark of acquired immunodeficiency syndrome (AIDS) [5] have been shown to have a similar prevalence in HIV-positive and HIV-negative individuals [6,7]. **Poka et al.** (2012) reported that the presence of intestinal helminths is largely determined by the level of sanitation and environmental factors than the health conditions of individuals in a given population [8]. Intestinal parasitic infections, nonetheless, have been implicated in life-threatening diarrhoea among HIV-positive persons [9,10] resulting in loss of body weight, indigestion, anorexia and dehydration, [9, 11].

Helminths are the most significant parasites that are endemic in Africa and other non-industrial nations, leading to disease burdens that are greater than those of common diseases including malaria and tuberculosis [12]. Sub-Saharan Africa has the highest burden of HIV globally, having more than 65% of new cases resulting in 75% of mortality with an estimated 71% of the individuals living with HIV [13]. There is a significant overlap in the geographical distribution of HIV and helminthiasis, and co-infection is highly endemic in Sub-Saharan Africa.

Nigeria is one of the countries with a high HIV epidemic in the world with an estimation of about 4.5 million infected people [14]. A significant proportion of Nigerians live in areas characterized by poverty and under-development and these two factors reportedly drive the epidemiology of HIV and intestinal helminthiasis. Helminths were identified in 51.5% of stool specimens from HIV patients obtained from research carried out at Federal Medical Centre Keffi, Northern Nigeria [15]. However, there is a lack of adequate information on the prevalence of intestinal helminths among adults in Nigeria.

Although, there is a high prevalence of co-infection of HIV and parasitic helminths in Sub-Saharan Africa, the consequences of intestinal helminths on the distribution of HIV, considering the increased chance of HIV transmission, proliferation and case-control pose a challenge [16]. Reports indicate that invasion by intestinal helminths damages the immune system leading to malfunction and reduced capability of the host to suitably protect against infections especially *Mycobacterium tuberculosis* and HIV [17]. In general, a great number of intestinal helminths cause the same immune reactions in the host despite the discrepancies in their biology, ways of transmission and proliferation [18].

Intestinal helminths frequently encountered include *Trichuris trichiura*, *Ascaris lumbricoides*, hookworm and *Strongyloides stercoralis, and Taenia* spp [19]. A few researchers have documented the utilization of mixed antiretroviral treatment to lessen the prevalence of intestinal helminths [20] in contrast other studies documented their capacity to influence the treatment with an ensuing expansion in viral replication and transition to AIDS [5,1].

This research investigated helminthiasis in HIV-positive patients attending the Faith Alive Foundation, a healthcare Centre located in the city Centre of Jos, the Plateau state capital, Nigeria. The present study investigated the prevalence and distribution of intestinal helminths among patients presenting to Faith Alive Foundation with intestinal symptoms. The results of this study will aid clinicians in making diagnosis and the data will also contribute to the overall understanding of the epidemiology of parasites in immune-compromised individuals in the catchment area of the hospital.

Subjects and Methods

Study population

This study comprised randomly selected HIV/AIDS subjects who visited Faith Alive Foundation Hospital for voluntary counselling, treatment and follow-up. A total of 169 consenting HIV positive participants attended Faith Alive Foundation, Jos, a non-governmental health care centre. Sixty (60) males and 109 females were enlisted for the study between the age range 15 and 70 years. Study Area. Exclusion Criteria used were Patients on anti-parasitic therapy or that had been on HAART for ≥ 6 months.

Study area

Faith Alive Foundation is a non-governmental institution situated in Jos metropolis, the capital city of Plateau State, Nigeria. The State is named after the picturesque Jos Plateau, a mountainous area in the north of the state with captivating rock formations. It has a population of around 3.5 million people and over forty ethnolinguistic groups. These ethnic groups are predominantly farmers and have similar cultural and traditional ways of life as people from other parts of the country. The climate on the Plateau is a semi-temperate climate with temperatures ranging from 18 °C (64.4 °F) to 25 °C (77.0 °F).

Ethical clearance

The study was approved by the Ethical Committee of Faith Alive Foundation Hospital, Jos, Plateau State (reference number FAFEC/08/34/30).

Data collection

The cross-sectional survey involved interviewing HIV/AIDS patients using a structured questionnaire. The questionnaires contained three sections which included: Demographic and socio-economic information (age, gender, residence, location, family size and occupation), Environmental factors (housing conditions and water supply) and health (history of intestinal parasitic infection and diarrhoea).

Sample collection and laboratory analysis

A stool sample was obtained from each study subject who gave consent to participate in the study. Laboratory analysis was carried out in the Microbiology Laboratory located at the University of Jos, Nigeria. Direct wet mount and formalin-ether concentration techniques were employed for the examination of the parasites [21]. Freshly voided stool samples were, first of all, inspected macroscopically for the presence of blood, mucus, tapeworm segments and other adult worms.

Direct wet (Saline) mounts were carried out by collecting 1 gram of the stool samples and placed in a clean leak-proof 5mm plastic tube and emulsified. Two millimetres (2ml) of saline from a wash bottle was added to the specimen and emulsified. A dropper was used to fetch the emulsified specimen onto two different clean grease-free slides. A drop of iodine stain was added to one slide and mixed with a coverslip and the coverslip was applied to it. A coverslip was also applied onto the second slide with the content unstained. The preparations were examined under the microscope for the ova or larvae of helminths.

Formol-ether concentration was carried out as outlined in WHO Standard Operating Procedures [22]. Half of a teaspoon of preserved stool specimen was placed inside a designated leak-proof stool container and emulsified with 4 ml of 10% formol water and transferred into a screw-cap tube. The content of the tube was sieved and collected into a beaker. The suspension was transferred into a glass conical centrifuge tube and 4 ml of ether was added. The tubes were covered with a stopper and mixed for 1 minute. The stopper was loosened and the tubes were centrifuged at 2000 revolutions per minute (rpm) for 5minutes. The particles of the stool sample on the side of the tube were distorted using an applicator stick and the tube was rapidly inverted to discard the ether, faecal debris and formol water. The tube was positioned upright and the remaining fluid drained down the bottom. The bottom of the tube was gently tapped to mix the sediments and a Pasteur pipette was used to transfer them onto two different slides. A coverslip was applied to one preparation and a thick smear was made out of the second preparation. The preparation under the coverslip was examined immediately under the microscope for parasites using the x10 and x40 objective lenses.

All data from this study were analyzed using IBM SPSS Statistics Version 21 software. Relationships between categorical variables were assessed using the Chi-square test and a *p*-value of 0.05 was considered statistically significant.

Results

A total of 169 consenting HIV positive participants were screened for intestinal parasitic infection (IPI). Of these 169 participants, 60 (35.5%) were males and 109 (64.5%) females. They were all aged between 15-and 70 years. The overall prevalence of intestinal helminths infection was 21.9%. Five different intestinal helminths were identified in the stool of HIV- positive persons. The helminths include the following in order of prevalence: *Ascaris lumbricoides* (10.0%), Hookworm (4.7%), *Taenia* spp (4.1%) *Strongyloides stercoralis* (3.0%) and *Trichuris trichiura* (1.8%).

Concerning socio-demographic factors **(Table 1)**, the prevalence of intestinal helminths was highest at 9(32.1%) among those within the age group 21-30 years followed by individuals within the age group 31-40 years, 12(25.5%) and lowest within the age group >60 years, 1(11.1%) (X^2 (5, N = 169) = 3.975, p = 0.553). Of the 60 males tested, 16(26.7%) were positive for intestinal helminths while of the 109 females tested, 21 (19.3%) were positive for intestinal helminths (X^2 (1, N = 169) = 1.239, p = 0.266). Twelve (12) out of 47 singles and 25 out of 122 married individuals were positive for intestinal helminths (X^2 (1, N = 169) = 0.504, p = 0.478). Concerning occupational status, civil servants had the highest prevalence of intestinal helminths, 12(35.3%), followed by self-employed, 6(28.6%), students, 4(28.6%), farmers, 4(23.5%), business owners, 10 (15.2%) while unemployed subjects had the lowest rate of infection, 1 (5.9%) (X^2 (5, N = 169) = 8.813, p = 0.117). Concerning risk factors and nature of stool samples collected from subjects studied, those who used stream water had the highest prevalence of infection, 2(33.3), followed by those who used borehole water, 21(32.3%), while the lowest prevalence was among those who used sachet water, 3(11.1%) (X^2 (4, N = 169) = 8.190, p = 0.085) **(Table 2)**. Infection was reported in 16.1% of those on highly active antiretroviral therapy (HAART) and 53.8% of those that were HAART-naïve (X^2 (1, N = 169) = 18.346, p = 0.001**) (Table 2). Individuals with watery stools had the highest prevalence of intestinal infections, 11(73.3%), followed by those with semi-watery stools, 21(25.3%) and the lowest among those with formed stools, 5(7.0%) (X^2 (3, N =169) = 32.932, p = 0.001) **(Table 2 and Figure 1)**.

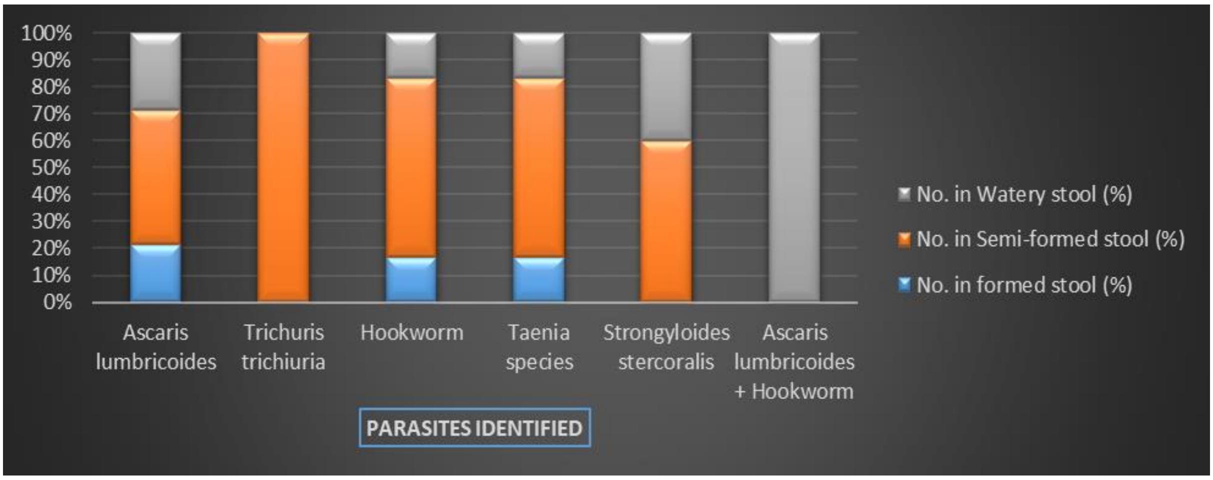
Table 1. Prevalence of intestinal helminths according to socio-demographic factors of HIV patients attending Faith Alive Foundation, Jos.

Parameter	No. of sample	No. positive (%)	χ^2	*p*-value
Age (years)				
≤ 20	8	2 (25.0)	3.975	0.553
21 – 30	28	9 (32.1)		
31 – 40	47	12 (25.5)		
41 – 50	50	9 (18.0)		
51 – 60	27	4 (14.8)		
> 60	9	1 (11.1)		
Total	169	37 (21.9)		
Sex				
Male	60	16 (26.7)	1.239	0.266
Female	109	21 (19.3)		
Total	169	37 (21.9)		
Marital status				
Single	47	12 (25.5)	0.504	0.478
Married	122	25 (20.5)		
Total	169	37 (21.9)		
Occupation				
Civil servant	34	12 (35.3)	8.813	0.117
Student	14	4 (28.6)		
Farmer	17	4 (23.5)		
Business	66	10 (15.2)		
Unemployed	17	1 (5.9)		
Self-employed	21	6 (28.6)		
Total	169	37 (21.9)		

Table 2. Prevalence of intestinal helminths according to risk factors and symptoms of HIV patients attending Faith Alive Foundation, Jos.

Parameter	No. of sample	No. positive (%)	χ^2	*p*-value
Source of drinking water				
Tap	48	7 (14.6)	8.190	0.085
Well	23	4 (17.4)		
Borehole	65	21 (32.3)		
Stream	6	2 (33.3)		
Sachet water	27	3 (11.1)		
Total	169	37 (21.9)		
HAART Status				
On HAART	143	23 (16.1)	18.346	< 0.001**
HAART naïve	26	14 (53.8)		
Total	169	37 (21.9)		
Stool consistency				
Formed	71	5 (7.0)	32.932	< 0.001**
Semi-formed	83	21 (25.3)		
Watery	15	11 (73.3)		
Total	169	37 (21.9)		

Figure 1. Occurrence of intestinal helminths based on stool consistency of HIV patients attending Faith Alive Foundation, Jos.



Discussion

This study reported a 21.9% prevalence of intestinal helminths among HIV-positive individuals. The presence of intestinal helminths in our study population shows that climatic conditions in Nigeria provide an enabling environment for the life cycle of intestinal helminths [23]. This study population has a higher prevalence of intestinal helminths compared to similar studies reported in Nigeria: 15.3% from Benin [19], 9.5% from Yola [31] 5.3% from Benin among patients on HAART [24], and 11.4% [25] from Kano, Nigeria However, higher prevalence of intestinal helminths have also been reported in Nigeria: 34.5% [26] and 58% [27] from Kano, 41.5% from Mkar, Benue State [14], 22.7% from Abuja [23], 24.0% from Toto, Nasarawa State [28], 29.6% from Nnewi [29], and 33.8% from Lagos [30]. The prevalence of infections in this study is also lower than findings from previous research work: 67% in North-Eastern Iran [6], 84.3% for Jakarta [11], 50.9% from Kenya [32], 37.9% from Malaysia [33], 53.0% from Dakar

[34] 40.5% from Cameroon [35], 43.5% from Gondar, Ethiopia [36], 63.9% from Brazil [37] and 81.5% from Equatorial Guinea [8]. The higher prevalence of intestinal helminths in these studies may be due to differences in the study period, study populations and intestinal helminths treatment given to patients on HAART, given that the study subjects were likely to be at different stages of HIV/AIDS disease and were at different periods of HAART. Furthermore, the difference in the prevalence of intestinal helminths could be attributed to knowledge of preventive and control measures like washing of hands after defecation, before and after eating, usually taught in the hospitals as reported in a study carried out in Nekemte, Ethiopia [38]. The use of sulphdoxine-trimethoprim as prophylaxis could also be a contributing factor to the lower prevalence of intestinal helminths in some locations [39].

Furthermore, the unique characteristic of each study area determines the extent and nature of the parasitic infestation. The specificity of the parasitological technique, demographic attributes of study participants and the number of samples examined in a particular study could determine the level of helminth infestation as well. Temporal differences have also been suggested as possible factors influencing the prevalence and endemicity of particular parasites in a study area [11, 29].

Five different intestinal helminths were identified in the stool of HIV-positive persons as follows: *Ascaris lumbricoides* (10.0%), Hookworm (4.7%), *Taenia* spp (4.1%) *Strongyloides stercoralis* (3.0%) and *Trichuris trichiura* (1.8%). The low burden of these helminths might have been because of the HAART status of the participants. Such low numbers have also been reported in similar studies in Nigeria. For example, only 4 helminths species were reported in Kano [25].

The prevalence of intestinal helminths with respect to HAART status indicates there were mono and mixed infections among those on HAART and HAART-naïve. However, the prevalence of intestinal helminths was significantly different among those that were not on HAART. Previous findings from Ethiopia showed that those that were not on HAART were 8 times more likely to harbour enteric parasites than those on HAART [40]. Studies have shown that HAART is protective in parasitic infection by inhibiting the parasites' aspartyl protease and also via reconstitution of the patient's immune system [20,40]. Therefore, the use of HAART in HIV patients reduces infestation of intestinal helminths and immune revival after the use of HAART reduces the burden and severity of intestinal helminths [41]. This shows the need to sensitize HIV patients about the use of HAART and treatment of intestinal helminths, especially in rural areas where coinfection with intestinal helminths is usually high. This corroborates with the UNAIDS 2025 targets which suggest that 90% of HIV patients have linked to context specific-integrated services [42]. However, some reports have shown that parasitic infections alter the effect of combined antiretroviral therapy leading to increased viral multiplication and disease progression [1,5]. The level of environmental hygiene and economic status is a strong determinant of helminth infestation apart from the role of the immune status of individuals [8].

Concerning socio-demographic parameters, gender was not statistically associated with the prevalence of parasitic infection ($p > 0.05$) although, the prevalence of infection was higher among males (26.7%) than females (19.3%). There is no clear reason for a higher prevalence of the infection in males but it could be due to the nature of outdoor activities and conditions; males are more exposed compared to females. Additionally, the occupation of the participants did not significantly affect the prevalence of intestinal helminths. Generally, those who reside in rural areas tend to face greater risk as they usually have to contend with unhygienic environments. These rural areas are known for perennial water problems with people living in rural communities possibly lacking potable water, thus, drinking from unhygienic water sources.

Conclusion

The prevalence of helminths among HIV positive individuals on HAART was less than among HAART-naïve individuals, suggesting the need for sustained advocacy on HIV testing and treatment. Given the paucity of data on the interactions between HIV and infestation of helminths in Jos, Nigeria, this study has provided baseline information that will guide the management and treatment of HIV and helminths co-infected patients. Continued advocacy on good sanitary and living conditions needs to be given more attention, especially among HIV infected individuals to reduce the risk of progression to AIDS due to parasitic infestation.

Conflict of interest statement
We declare that we have no conflict of interest.

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