

Prevalence and Intensity of Infection of Gastrointestinal Helminths of Inmates in the Bamenda Central Prison, North West Region of Cameroon

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Abstract: Helminths are soil transmitted nematodes with life cycles that involve no intermediate host or vector and are among the most prevalent of chronic human infections worldwide. The main aim of this study was to determine the prevalence and intensity of infection of gastrointestinal helminths among inmates in the Bamenda Central Prison, Mezam Division, North West Region of Cameroon. Three hundred and ninety three (393) stool samples were collected from (385 males and 8 females) inmates aged 16 to 84 years in 14 Cells inside the prison between a period of September 2014 and February 2015. Qualitative and quantitative analysis of stool samples were carried out using the Flotation and McMaster techniques respectively. Of the 393 number of stool samples examined, 27 (6.87%) persons were positive with at least one helminth infection. From the results obtained, three species of nematodes were detected with a prevalence rate of 5.08% for *Necator americanus* (Hookworm), 1.27% for *Ascaris lumbricoides* and 0.51% for *Trichuris trichiura*. Out of the 385 stool samples collected from males, 26 (6.61%) were positive for nematode infections. Amongst females, only one had a nematode infection with a prevalence rate of 0.26%. The mean intensity for *Necator americanus*, *Ascaris lumbricoides* and *Trichuris trichiura* was 370 ± 611.81 , 130 ± 115.11 and 75 ± 35.35 egg per gram of faeces respectively. The degree of infection was light for both *Ascaris lumbricoides* and *Trichuris trichiura*, and moderate for *Necator americanus*. The trend of infection was low in *Ascaris lumbricoides* and *Trichuris trichiura*, but high in *Necator americanus*. The prevalence of these parasites was very high in cells A and B than in the other cells. Multiple infections were more common amongst the inmates than single infections with the older inmates more infected than the younger ones. These results showed that gastrointestinal helminths vary in relation to different Prison cells and age of the inmates. There should therefore be need to educate the prison population on Health education and practice of hygienic habits, in order to fight effectively against these diseases in the inmate community.

Keywords: Prevalence, Intensity, Gastrointestinal Helminths, Inmates, Bamenda, Cameroon

1. Introduction

Intestinal helminths are organisms living within their hosts, in the gut, body cavity, lungs, intestines or other tissues. Such forms nearly always live a completely parasitic existence. These parasites can be gastrointestinal parasites such as helminths and protozoans. The commonest and well known gastrointestinal helminths of man are

Ancylostoma/Necator spp, *Ascaris lumbricoides*, *Strongyloides stercoralis*, *Trichuris trichiura* and *Enterobius vermicularis* [1]. Several studies carried out in some parts of the world have shown that prison inmates are mostly infected with intestinal parasites and other forms of illness [2, 3, 4, 5]. These parasites are distributed worldwide, particularly in the tropical and sub tropical areas [6]. Around the world, a significant percentage of individuals (criminals) enter the

prison already infected with gastrointestinal helminths which can be transmitted from one person to another especially through contaminated food. The action of these parasites on man can be translated by the alteration of their health state and the reduction of their productive success. Scientific studies according to [7] have shown that all age and sex groups in prisons suffer from gastrointestinal helminthic infections and other diseases. Infections are high among populations who are heavily exposed in low income countries, in 720 million clinical cases, an estimate of 135,000 deaths attribute to clinical complications annually [8]. It is estimated that 3.5 billion people are infected with these parasites, and that 450 million inmates in the world are ill as a result of these parasitic infections. Studies carried out by [9] amongst inmates in Maiduguri, Nigeria revealed that 77 (64.20%) out of 120 inmates were infected in 1994. This means that inmates in prisons are at a very high risk of becoming infected as some are released, others are being detained at any moment. The high prevalence of these parasites in prisons is promoted by several factors such as poor hygiene and sanitation, malnutrition, lack of appropriate lodging and Medical facilities, poor toilet facilities and poor

or lack of potable water sources in prisons. It is for these reasons that the principal objective of this study was to identify the gastrointestinal helminths that infect inmates in the Bamenda Central Prison.

2. Methods

Area of study

This study was carried out between September 2014 and February 2015 in the Bamenda Central Prison found in Bamenda I in the Mezam Division, North West Region of Cameroon. The climate of Bamenda is typically tropical with two seasons, the dry season and the rainy season. The rainy season begins from about mid March to sometimes in mid October. The dry season begins from mid October to about mid March. The temperature in the dry season sometimes go as high as 38°C during the day and as low as 15°C at night. In the rainy season, the temperature is generally milder with an average daily temperature of about 25°C. The climate is gradually reducing conferring a high rainfall and a conducive environment for accusation/transmission of most gastrointestinal parasites [10].



Figure 1. Map of Cameroon showing location of Bamenda and other regions in Cameroon.

Type of study

A Prevalence study was carried out in the 14 cells of the Bamenda Central Prison North West Region of Cameroon. The inmates were randomly selected from all the Prison cells inside the Prison.

Study design

A descriptive study was carried out in which stool samples were collected from inmates with a signed informed consent and analyzed for the presence of gastrointestinal helminths.

Distribution of Questionnaires

To carry out this research, an ethical clearance was obtained from the National Ethics Committee of Cameroon,

in order to ensure consent and confidentiality of the participants.

Questionnaires were distributed to the delegates of the different cells at the infirmary. A sample questionnaire was given to each of them to study, which was taken to the different cells in the evening for the other inmates to fill. The questionnaires were brought back the following day and handed to the researcher.

Distribution of specimen bottles

Dry wide-mouth plastic bottles with tight fitting lids were distributed to the respondent. Only those who accepted to sign the informed consent were given questionnaires and specimen bottles. Each specimen bottle carried three codes; date of collection, cell of collection and serial number. The inmates were instructed to fill the labeled plastic clean containers with feces first thing in the morning that is, before 10 am and bring back to the researcher. The inmates were instructed not to contaminate the stool samples with urine or water during collection because water may contain free-living organisms that could be mistaken for human parasites and urine may destroy motile organisms. The following day, the respondents re-submitted their sample bottles with stool having the identification serial number placed on them.

Collection of questionnaires and specimen bottles

Inmates who filled the questionnaire form and with a signed informed consent gave fresh stool samples. These containers were collected the next morning and the stool samples were preserved immediately in 10 % aqueous formaldehyde (10 g of stool to 3 mL of 10 % aqueous formaldehyde) solution [11, 12]. These samples were then

transported in a leak proof dark bag to the laboratory for analysis.

Parasitological examination

Corprologic analysis was done to have a quantitative and qualitative determination of the prevalence of infection of the parasites. For the qualitative analysis, faeces were analyzed by the flotation technique using saturated sodium chloride solution as described by [13]. Quantitative analysis was by determination of the number of eggs per gram of faeces, the McMaster technique described by [14] was used.

Statistical analysis

Both descriptive and inferential statistical procedures were used. Tables and graphs were used in displaying results. The Chi-square (χ^2) test of independence used to test the hypothesis of whether parasitic diseases infect independent of cells in which inmates were detained and in relation to their ages. The level of significance was tested at 5%.

3. Results

Prevalence of gastrointestinal helminths in the study area

A total number of 393 stool samples were collected from inmates and only 27 inmates were infected with at least one gastrointestinal helminth (nematode infections) with an overall prevalence of 6.87%. 20 (5.08%) persons were infected with *N. americanus* (hookworm), 5 (1.27%) with *A. lumbricoides* and 2 (0.51%) with *T. trichiura*. No significant difference ($P > 0.05$) existed between the prevalence rates of *A. lumbricoides* and *T. trichiura*.

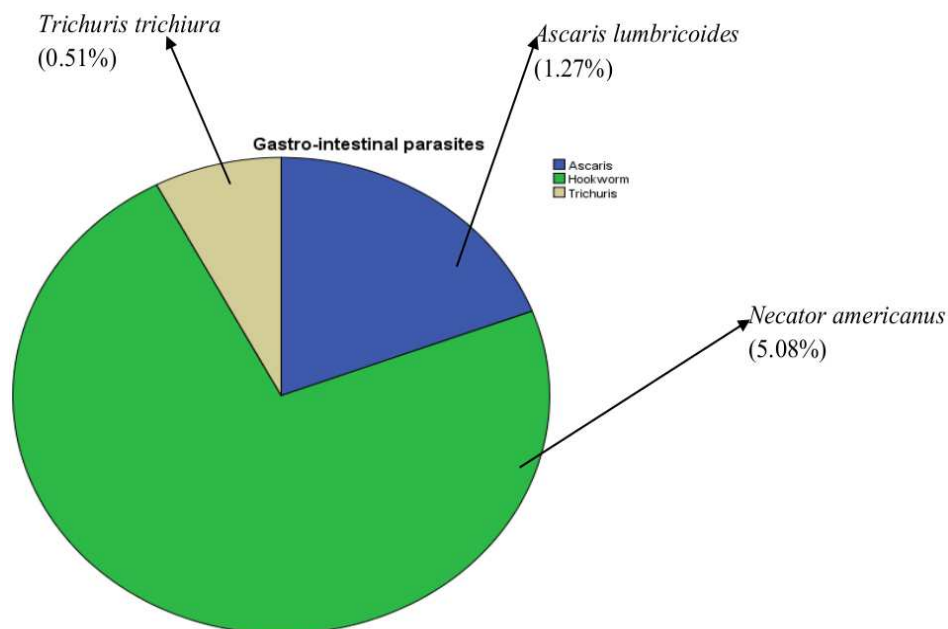


Figure 2. Prevalence of gastrointestinal helminths identified in the Inmates.

Overall intensity of infection for gastrointestinal nematodes in the study area

Intensity is the number of eggs per gram of faeces (EPG). The overall mean intensity of the three gastrointestinal nematodes was 370 ± 611.81 , 130 ± 115.11 and 75 ± 35.35

for Hookworm, *A. lumbricoides* and *T. trichiura* respectively. The average intensity for Hookworm was significantly different from those of *A. lumbricoides* and *T. trichiura*.

Influence of age on intensity of nematode infection

The intensity of infection of gastrointestinal helminths

varies with age of the inmates (Table 1). The highest intensity of infection in this study was observed in Hookworm in the following age groups 20-29, 30-39 and 40-49 years old. *A. lumbricoides* recorded a high intensity of infection between the age group 30-39 years old. *T. trichiura* recorded a very low intensity of infection in all the age groups. A significant difference existed between the intensity of infection for Hookworm compared to the other two parasites.

Table 1. Influence of age on intensity of nematode infection in the study area.

Age	Gastrointestinal helminths encountered		
	Hookworm	<i>A. lumbricoides</i>	<i>T. trichiura</i>
10-19 years	100		
20-29 years	400±742.1	50	50
30-39 years	164.3±102.9	183.3±124.8	100
40-49 years	966±907.4		
50+ years	50	50	

Prevalence of gastrointestinal helminths with respect to Prison Cells

The cell with the highest prevalence of gastrointestinal helminths was cell A while cells with no gastrointestinal helminths at all were the Infirmary, Juveniles, Special cells and WC (Table 2).

Table 2. Prevalence of gastrointestinal helminths with respect to Prison Cells.

Name of Cell	Gastrointestinal helminths	Prevalence (%)
A ward	8	2.03
B ward	5	1.27
C ward	2	0.51
D ward	4	1.02
E ward	3	0.76
F ward	1	0.25
Female wing	1	0.25
G ward	1	0.25
H1	1	0.25
H2	1	0.25
Infirmary	0	0
Juveniles	0	0
Special Cell	0	0
WC	0	0
TOTAL	27	6.87

Degree of infection of intestinal helminth parasites

According to [15], the degree of infection or parasite charge is classified into light, moderate and heavy. The following intervals on the table 3 below were obtained.

Table 3. Distribution of mesoparasites in relation to degree of infection in the study population.

Parasites	Degree of infection		
	Low	Moderate	Heavy
<i>Ascaris lumbricoides</i>			
Trichuris trichiura	3	2	0
Hookworm	2		
Total	9	14	4

The table 3 above shows that 4 inmates had a heavy degree of infection, followed by 14 inmates who showed a moderate degree of infection and lastly, 9 inmates with a low degree of infection. Distribution of intensities in relation to the degrees

of parasite charge were as follows; 3 inmates were infected with *A. lumbricoides*, 2 with *T. trichiura* and 4 with Hookworm recording a low degree of infection. For those who had moderate degree of infection, it was observed that 2 inmates were infected with *A. lumbricoides* and 12 inmates with Hookworm. Also, it was noted that a heavy degree of infection was in 4 inmates infected with Hookworm.

Frequency of association of single and double gastrointestinal helminth infections

In the course of this study, 393 inmates examined, 3 inmates were infected with *A. lumbricoides* only, 18 with Hookworm infection only and one person infected with *T. trichiura* only. For double infection, one person was infected with *A. lumbricoides* and Hookworm and another person infected with *T. trichiura* and Hookworm.

From the study, the prevalence of mono-parasitism was 5.59% and that for biparasitism was 0.5% with a general prevalence rate of (6.09%). The association between *A. lumbricoides* + *T. trichiura*, *T. trichiura*+Hookworm recorded the same prevalence 1(0.25%) while that of *A. lumbricoides* + *T. trichiura* was 0%. It is worth noting that no significant difference was observed for both mono-parasitism and biparasitism amongst inmates.

4. Discussion

Three gastrointestinal helminths (geohelminths) *A. lumbricoides*, *N. americanus* (Hookworm) and *T. trichiura* were identified in the prison, based on faecal examination giving an overall prevalence of 6.87%. This prevalence is lower than (59.80%) recorded in Nigeria by [16] who reported helminths as the highest occurrence. This could be due to the changes in the hygiene and sanitary habits of the inmates during these years. This prevalence differs from that obtained by [17] who reported a high prevalence (32.40%) of helminth infections. This overall prevalence is far lower than 42.2% recorded in Dschang Cameroon by [18]. This overall prevalence is close to that reported in Bafoussam (12.27%) by [19]. The prevalence was relatively higher than the report of [20] in Northern Tanzania (2.7%). However, this present work indicated that Hookworm was the most prevalent (5.085), followed by *A. lumbricoides* (1.27%) and lastly by *T. trichiura* with a very low prevalence of 0.51%. The high prevalence of hookworm could be due to the route of infection being skin penetration, as inmates hardly wear protective shoes. The presence of the three gastrointestinal nematodes encountered in this study could be due to several factors such as unhygienic conditions of the inmates. This is because nematode infections are transmitted through skin penetration especially Hookworm by larval stage. This could partly be accounted for by the poor environmental conditions which prevail in the prison cells, the inner court and the immediate external environment of the inmates as also reported by [16]. These behaviors promote faeco oral transmission of the above nematode infections. These results are also in accordance with those of [21] in Ethiopia which registered a high prevalence of 20.1%

for Hookworm, followed by 14.7% for *A. lumbricoides* and 3.3% for *T. trichiura*. However, these results do not corroborate with those of [22] carried out in Cameroon where they observed a high prevalence of 27.0% for *T. trichiura*, followed by 20.0% for *A. lumbricoides* and 19.0% for Hookworm. Also, these results are different from those of [23] in Lagos Nigeria who registered a prevalence of 67.7% for *A. lumbricoides*, 45.0% for Hookworm and 31.3% for *T. trichiura*. These differences in the order of parasite prevalence between our study and those of other authors could be due to the different climatic conditions, associated with risk factors which favour and influence the development and distribution of helminth eggs [24]. These factors can vary from one study site to the other, in the same region or in the same country [25]. It is also to be noted that these differences could be as a result of the fact that the sample size was very different from one study to another, and also the coproparasitological techniques used [26]. In this case, these authors encountered the same geohelminths like those obtained from our study, this explains that these gastrointestinal nematodes are cosmopolitan [27]. The low prevalence of gastrointestinal helminthes in this present study might also be due to the fact that, the three major intervention methods for STH infection are respected in the study area: anti helminthic drug treatment, sanitation, and health education. Anthelmintic treatment is aimed at reducing morbidity by decreasing the worm burden. Improved sanitation is aimed at controlling transmission by reducing food and water contamination. Health education is aimed at reducing transmission and re-infection by encouraging healthy behaviors [28].

The intensity of the various gastrointestinal helminthes encountered varied with age. This observation can be justified by the fact that some age groups were equally exposed to infection than others. The intensity of these helminths was high in the 20-29 and 40-49 years age groups. These findings are in accordance with the work of [21] and differ from the work of [29] on trichuriasis in Dschang. These age groups were mostly composed of “corvey” workers, that is, some of the male inmates going out of the prison for daily jobs. Our results and those of [30] in India have shown that all age groups were infected with at least one gastrointestinal helminth as the intensity of infection varied between the different age groups. This means that there is no individual who is truly resistant to gastrointestinal helminth infections in relation to age [31]. Literature from other authors presents the younger groups in prison as being the most exposed to gastrointestinal tract nematodes due to a number of factors like indiscriminate defecation, unhygienic practice of eating without washing hands [32]. This is not the case in the study community because the adult and older age groups were the most infected and registered the highest intensity of gastrointestinal helminths in this study. Thus these results are totally different from those obtained by [33] who reported that the younger age group showed the highest intensity of infection. The high intensity of nematode infection in the

older age groups may be accounted for by the fact that most of them were serving the last years or months of their prison sentence at the time of the study as it is believed that duration in prison has an impact on the inmates. Hence they have stayed for long under prison conditions than those in the other age ranges, and have been malnourished for longer periods. It is also known that malnutrition increases susceptibility of infection through impaired local and systemic host defense mechanism as reported by [34]. The high intensity of infection amongst these age groups could be due to the fact that they have stayed for long without taking anthelmintic treatment as most of them believe in traditional herbs and refuse medical treatment.

Furthermore, Hookworm recorded the highest degree of infection (20%) and was the most widespread species, while *A. lumbricoides* and *T. trichiura* had very low proportions (0.0%). These observations are confirmed by those of [35] in Ecuador where the highest degree of infection (8.5%) was noted in Hookworm being the most prevalent, followed by *A. lumbricoides* and *T. trichiura* with low proportions. In general, majority of the infected inmates were at a low rate for degree of infection. Although [33] reported that the probability of contracting ascariasis, hookworm infection and trichuriasis are equal in both sexes, these results and those of [19] depicted the contrary. This is so because in the present study, both sexes were not equally exposed to the same degree of infection. The difference in the trend of infection for all the parasites (high or low prevalence) could be due to seasonal variations and risk factors in the study area such as age, poor hygienic habits, overcrowding and poverty. These findings corroborate with those of [16] reported in Nigeria in 2013. According to [35], this low rate of degree of infection for *A. lumbricoides* and *T. trichiura* could probably be as a result of the regular administration of anthelmintics in some inmates. The most common medication given to these inmates by the prison authority is Vemox (Mebendazole) against intestinal parasites. This is no doubt accounts for the low prevalence of *A. lumbricoides* and *T. trichiura* generally noticed amongst inmates in the Prison.

5. Conclusion

The present investigation was designed to study the prevalence and intensity of gastrointestinal helminths of inmates in the Bamenda Central Prison (Mezam Division). It is worth noting that the prevalence of gastrointestinal helminths evaluated for the concerned sample was relatively low. This present investigation showed that the inmates were infected with three gastrointestinal helminthes (*A. lumbricoides*, *N. americanus* or Hookworm infection and *T. trichiura*). Hookworm infection was the most prevalent nematode, accompanied by *A. lumbricoides* and then *T. trichiura*. Hookworm also recorded the highest mean intensity followed by *A. lumbricoides* and lastly *T. trichiura* with a very low mean intensity. The age infectivity varied within the ages and prison cells with high rates in adult male's cells and very low rates in the single female cell. This is linked to a good number

of extra activities such as going out of the prison for daily jobs which is relatively accounted in males than in females, which increases their risk of infection. The result underscored the importance of proper hygiene and sanitation in the prison as this will reduce the infection rate.

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