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Status of intestinal parasites in inmates of a correctional facility, Jos, Nigeria

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Abstract

Correctional inmates are among the vulnerable groups to intestinal parasitic infections due to deprived situations characterized by inadequate facilities, malnutrition, scarce potable water, over-crowding, and poor hygiene. Two hundred and fifty faeces of inmates of Jos Correctional Facility were investigated for the prevalence of intestinal parasites between May and June 2019, using the wet mount and formol-ether concentration techniques. Results obtained showed that from the 250 faecal samples examined, 57(22.8%) were infected with various intestinal parasites. Nine (9) different intestinal parasites identified were *Entamoeba histolytica* 38.60%), *Entamoeba coli* (15.78%), *Ancylostoma duodenale (*4.04%), *Ascaris lumbricoides (*0.53%), Taeniasp (8.77%), *Schistosoma mansoni (*3.51%), *Giardia lamblia* (3.51%), *Enterobius vermicularis (*3.51%) and *Trichuris trichuria (*1.75%). The 9 different intestinal parasites were grouped into helminthes (42.1%) and protozoa (57.9%). Higher infection rate of 45.6% was recorded among those within age ranges 21-30 years. Inmates who were in prison for <2 years had higher (56.1%) infection rates compared with other inmates (43.9%). The findings are in agreement with similar studies from other penitentiaries in Nigeria resulting in significant health problems among inmates including anemia, malabsorption in the gastrointestinal tract and other complications. Thus, the need to scale up periodic routine examination of all inmates including stool samples, hemogram and the prompt treatment of infected individuals would significantly improve their health conditions.

Keywords: Intestinal parasites; Jos Prison; inmates and prevalence.

Introduction

Penitentiaries in developing countries have been stalemated with little or no improvements to their environments. The Federal Government of Nigeria has undertaken sweeping policy changes to how inmates will be managed within the facilities and to change the narratives through reforms [1]. Correctional facilities are viewed as a physical structure within a specific geographical location which affords a unique kind of social environment that is different from the larger society where people live according to specialized conditions [2].

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Audu *et al* 2014 conducted a study on the assessment of a five-year disease profile of inmates in three prison formations in Kaduna State reported that psychiatric cases (24.1%), followed by gastro-intestinal diseases (22.6%) amounted for high dominant health problems with lesser prevalence on respiratory tract disease (10.1%), dermatology/ allergy (5.4%), and cardiovascular diseases (2.4%)[3].

Globally, intestinal parasites cause significant morbidity and mortality particularly in developing countries with prevalence rates as high as 90% [4-5].

Parasitic infections may remain in apparent or may cause disease of clinical significance which depends on both the parasitic (strain, number, metabolic process) and host (age, natural immunity, infection, co-existing disease nutritional status, lifestyle) factors [6].

Several studies reported that Nigerian prisons are characterized by several epidemiological factors such as poor sanitation, environmental degradation, ignorance, poor personal and community hygiene, chemical condition and other socio-cultural practices such as the use of night soil for fertilizer [7-10]. The prevalence of these parasites is promoted by easily contracting them through eating raw and under-cooked feacal contaminated vegetables as well as other foods [11].

Prison inmates are among the vulnerable groups to intestinal parasitic infections. In developing countries, prison inmates live in deprived situations characterized by inadequate facilities, malnutrition, scarce potable water, over-crowdedness, and poor hygiene [12]. Besides this, prisoners have no control of their environment in which they live, which puts them at risk of infection with intestinal parasites [13].

Intestinal helminthes are parasitic diseases with high morbidity and mortality in most tropical parts of the world, they are often referred to as the neglected (forgotten) disease because they are not subject to periodic reporting like other parasitic disease such as malaria infections [14-15]. Prisoners harbour diseases that are determined both by the environment from which they come and by the prison in which they live. Human intestinal helminthiasis exists in every country in the world, but the prevalence of the disease varies considerably between countries and within population in response to predisposing factors [16-18].

Several studies in Nigeria have shown that prison inmates are infected with intestinal parasites and other forms of illness, the above review have undoubtedly established the existence of different intestinal parasites among inmates of many prisons in Nigeria [19-22].

Okolie *et al* (2008), who studied on intestinal distribution among inmates of Owerri Prison, reported a 77% incidence of intestinal parasites with *Giardia lamblia* having the highest occurrence of 17.7% and *Strongyloides stercolaris h*aving the lowest incident rate [23]. Colman S. *et al* (2013) who also worked among Maiduguri prison inmates in 2013 revealed an incidence rate of 32.84% of intestinal parasites with *Entamoeba coli* occurring most at a 9.95% rate while Taenia sp. was the lowest in occurrence at 0.05% rate [24].

Materials and methods

Study area, population and design

Jos Correctional Facility is located between Latitude 80° 24′N and Longitude 80° 32′ and 100° 38′E within the metropolis of Jos, the capital of Plateau State North Central Nigeria. The population of inmates at the Jos Prison ranges from 1,800-1,980 having females less than 60, but no female presented herself for the study. Thus, 250 stool samples were collected from male inmates only within the age bracket of 18 and 88 years.

Socio-demographic and Body Mass Index (BMI) data were collected by interviewing study participants using structured questionnaire after explaining the purpose and relevance of the study to them. Inmates were then categorized into age groups, jail term sentences which comprised of those serving short-term sentences (STS) 1 year and below, serving medium term sentences (MTS) 2-5 years and those serving long-term sentences (LTS), above 5 years. Duties assigned to each inmate, antiparasitic therapy and source of food were other categories assigned to each inmate under study.

Ethical approval

Ethical clearance was obtained from the Health Research Ethics Committee of Bingham University Teaching Hospital, Jos, Plateau State Nigeria [(PLS/ SHQ.113/Vol.IX/267, NHREC/21/05/2005/00673)] before commencement of study. Institutional permission were obtained from the authorities of the Jos Correctional Facility

Collection and examination of stool samples

Convenient sampling method was used for this study where 250 male inmates under study were instructed and educated on how to collect stool samples without contaminating it with urine. About 1.0-2.0 g of stool sample were collected in a pre-labeled, leak-free, plastic specimen cups following an official consent secured from the prison officers and the inmates and assurance of confidentiality of results.50 stool samples were collected every week for a period of five (5) weeks (from May 20 to June 21, 2019). Stool

samples collected were sent immediately to the Bingham University Multidisciplinary Laboratory for examination accordingly. All stool samples were analyzed using direct wet mount (normal saline and lugol's iodine) and formol/ether concentration method according to Cheesbrough (2005) and Nock (2000); and examined under the microscope using 10x and 40x objectives, respectively [25-26]. The quality of laboratory analysis was maintained by following standard operating procedures during pre-analytical, analytical, and post-analytical phases.

Data analyses

Frequency distributions of variables were calculated and analyzed using percentages and *chi*-square (x^2) test to compare the rate of infections with independent risk factor and the occurrence of intestinal parasites by declaring statistical significance when p-value is less than 0.05 at 95% confidence interval.

Results

Of the 250 inmates participated through convenient sampling method. 57 (22.8%) were infected with various intestinal parasites. Nine (9) different intestinal parasites were identified: *Entamoeba histolytica* (38.6%), *Entamoeba coli* (15.8%), *Ancylostoma duodenale* (14.0%), *Ascaris lumbricoides* (10.5%), Taenia spp. (8.8%), *Schistosoma mansoni* (3.5%), *Giardia lamblia* (3.5%), *Enterobius vermicularis* (3.5%) and *Trichuris trichuria* (1.8%) (Table 1). In Table 2, six (6) of the intestinal parasites identified were helminthes with 42.1% while 3 were protozoa with 57.9% respectively. In table 3, higher infection rate was recorded among those within age ranges 21-30 years with 45.6% prevalence. Inmates who were in prison for less than 2 years had 56.1% infection rate than other inmates. Furthermore, 67 of the sampled population had just completed treatment with an antiparasitic drug (mostly flagyl) out of which 13 was still infected with intestinal parasites. Inmates that had roles within the facility had a 29% prevalence rate. Those who had post primary education had a 22.8% prevalence rate as against those with primary and no formal education with 77.2% prevalence rate in each case. Of those infected, 85% strictly fed on the food given them within the prison facility while 15% had their meals mostly sent to them by friends and relatives outside the facility as compared with their Body Mass Index only 14% of infected inmates fall into this category (Tables 3 and 5). All the inmates used the same kind of toilet facility and drank from the same water source, hence that did not significantly determine the risk of intestinal parasitic infection. The infectivity of intestinal parasites among Jos inmates reported does not depend on age, jail terms or role/duties assigned to them (Table 4). Thus, there is no significant difference at $p<0.05$. However, infectivity is dependent on their level of education which significantly determines the risk of infection due to poor education and knowledge (p-value: 0.043).

Table 1. Distribution of the intestinal parasites identified from the inmates in the Jos Penitentiary.

Intestinal parasites	Frequency $n=57$	Percentage (%)
Entamoeba histolytica	22	38.6
Entamoeba coli	9	15.8
Ancylostoma duodonalex	8	14.0
Ascaris lumbricoides	6	10.5
Teania sp.	5	8.8
Schistosoma mansoni	2	3.5
Giardia lamblia	2	3.5
Enterobiusvermicularis	2	3.5
Trichuris trichura	1	1.8

Table 2. Classification of intestinal parasites identified from the inmates in Jos Penitentiary.

Classification	Frequency $n=57$	Percentage (%)
HELMINTHS:		
Nematodes	17	29.8
Ancylostomaduodenale		
Ascarislumbricoides		
Enterobiusvermicularis		
Trichuristrichuria		
Cestodes	5	8.8
Teania sp.		
Trematodes	2	3.5
Schistosomamansoni		
PROTOZOA:		
Amoeba	31	54.4
Entamoebahistolytica		
Entammoeba coli		
Flagellates	2	3.5
Giardia lamblia		

Table 3. Infectivity of the intestinal parasites in relation to age, jail terms, educational level and role/ duties assigned to inmates in Jos Penitentiary.

Characteristics	No. examined	Protozoa	Helminthes	Total (%)	*p*-value
Age group					0.9269
18-20	28	6	6	12(21.1)	
21-30	11	81	51	126(46.5)	
31-40	76	7	5	12(21.1)	
41-50	18	3	1	4(7.0)	No significant
>51	10	2	1	3(5.2)	
Jail terms					0.25
STS (<2 years)*	159	16	16	32(56.1)	
MTS (2-5 years)**	45	12	4	16(28.1)	No significant
LTS (>5 years)***	46	5	4	9(15.8)	
Educational level					0.043
None formal	22	8	4	12(21.1)	
Primary school	85	21	11	32(56.1)	
Secondary school	125	3	9	12(21.1)	
Tertiary	18	1	0	1(1.7)	Significant
Roles/duties Assigned					2.9
No role assigned	178	22	18	40(70.2)	
Soil/water related activity	24	4	1	5(8.7)	
Artisans	25	3	3	6(10.5)	
Admin roles	7	1	2	3(5.3)	No significant
Students/Teachers	16	3	0	3(5.3)	

*STS = Short Term Stay, **MTS = Medium Term Stay, *** LTS = Long term stay.

Table 4. The infectivity of the intestinal parasites in relation to risk factor for inmates in Jos Penitentiary.

Characteristics	No. examined	Protozoa	Helminthes	Total (%)	*p*-value
Antiparasitic therapy					0.736
Not on antiparasitic one month prior to study	183	26	18	44(77.2)	No
On antiparasitic two/more months prior to study	67	7	6	13(22.8)	sign
Source of food					0.414
From prison facility only	210	26	23	49(85.6)	No
From outside the prison facility	40	3	5	8(14.0)	sign

Table 5. Infectivity of intestinal parasites in relation to Body Mass Index (BMI) of inmates in Jos Penitentiary.

Body Mass Index (BMI)	Frequency *n*=57	Percentage (%)
Under weight	8	14.0
(<18.3 kg/m^2)	35	61.4
Normal weight	13	22.8
(18.5-25 kg/m^2)	1	1.8
Over weight (25-30 kg/m^2)		
Obese (>30 kg/m^2)		

Discussion

The prevalence of intestinal parasites in this study (22.8%) is lower than other studies conducted in some Nigerian prisons such as Keffi with 74.85% [22], Owerri with 77.0% [23] and Maiduguri with 32.84% [24], but comparable with the report from Kisii Prison in Kenya, with an overall prevalence of 24.7% [27]. The variations in the prevalence of intestinal parasites between the different prisons may be attributable to the difference in the sanitary condition of prison services, laboratory techniques applied, and environmental conditions [28].

From this study, protozoa recorded a prevalence of 57.9% which differed with the report from studies in Owerri (44.6%) [23], Maiduguri (9.95%) [24]; and helminthes recorded a prevalence of 42.1% which also differed with Maiduguri (22.89%) and Owerri (32.4%). Possible reason for a higher protozoan prevalence in this study is likely because protozoa are immediately infectious where eggs of helminthes may need a while to become infective [18, 22, 24, 29].

The presence of *E. histolytica* with the highest prevalence of 38.6% in this study, differed with works done in some other Nigerian prisons [Maiduguri

(4.5%), Owerri (15.0%) and Keffi (19.8%)] yet agreed with work done in Kisii Prison and Makelle Prison in Kenya and Ethiopia [8, 22, 30, 31].

In Qatar, Abu-Madi *et al* (2008), reported that *A. duodenale* occurs more frequently in mild and humid conditions as free-living larval stages are unlikely to survive under extremes of temperature and desiccation as normally experienced in Jos and environs, our study recorded a prevalence of 14.04% [31]. However, its incidence in this study can also be attributed to improper sanitation and hygiene within the prison environs.

Most of the inmates that availed themselves for this study were youths of ages 21-30 years old with prevalence of 10%. It is however believed that these age groups are the most active and highly infected group of inmates in the prison. The same trend was observed by studies carried out in Kisii Prison, Kenya, Owerri Prison, eastern Nigeria and Mekelle Prison, Ethiopia [23, 27, [30].

As regards jail terms, inmates serving short term sentence (STS) had high intestinal parasitic infection rate of 56.1% as compared to the inmates serving mid-term sentence (28.1%) and long term (15.8%). This finding concurred with the reports by Ughava *et al* (2016) and Dickson *et al* (2016) who reported a higher prevalence among the short term prisoners [27, 32]. This is likely because inmates in this unit (short-term section) are regarded as the mobile and working inmates as manual labourers which predisposes them to intestinal parasitic infections. However, the low intensity of intestinal parasitic infection recorded among inmates at long-term sentence may be due to their constant confinement, which prevents them from being exposed to intestinal parasitic infections.

The effect of the levels of education on the risk of infection with intestinal parasites was evaluated. This turned out to be statistically significant (*p*-value: 0.043). Those with primary school education as well as those who had no formal education recorded a higher (77.2%) prevalence rate than those with higher education (22.8%). It is indicative that higher level of education is usually associated with awareness about parasitic infection risks however; unschooled inmates were mostly infected with intestinal parasites as compared to those inmates with post primary education.

Antiparasitic therapy was also compared in the study. Yet the incidence of intestinal parasites even among subjects that had earlier been on antiparasitic therapy might likely be due to re-infection or incomplete adherence to antiparasitc dosage as admitted by some of the subjects. However, antiparasitic drugs such as metronidazole and Mebendazole were administered to those found to be infected. Furthermore, our study revealed that the source of food does not significantly affect infectivity.

World Health Organization (WHO), 2012 regards a Body Mass Index (BMI) of less than 18.5 kg/m^2 as underweight and may indicate malnutrition, an eating disorder or other health problems. In this case, only 14% of infected inmates fall into this category as reported in our study. Since BMI is influenced by malnutrition, it may point to the fact that majority of the inmates are adequately fed [29].

Conclusion

This study shows that intestinal parasites are significant health problems among inmates of Jos Penitentiary and largely due to poor hygienic conditions. The Federal Government of Nigeria needs to deliberately intensify on best environmental practices, routine medical checks including laboratories for all its penitentiaries in the States and districts including food safety. The complete absence of health education and communication materials require a startup for all penitentiaries in Nigeria.

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