



Commonness and Risk Factors Associated with Gastrointestinal Parasitic Infections among Inmates of Port Harcourt Children's Home

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Authors' contributions

This work was carried out in collaboration among all authors. Author AAA conceived the study. Author AAA designed the study protocol. Author EK collected the data. Author GLBB analyzed and author EK interpreted the data. Author AAA wrote the manuscript and author GLBB revised the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: Gastrointestinal parasites are important health problems among most societies.

Objectives: Prevalence and risk factors associated with gastrointestinal parasites among inmates of Port Harcourt children home.

Methods: This prospective study was carried out in August and September 2019 at the Port Harcourt children home. Fecal samples were collected from 63 healthy looking inmates and examined macroscopically and microscopically (using normal saline and iodine wet mount, formalin-ether sedimentation and modified Ziehl Neelsen staining) methods. Finally, data was analyzed using descriptive statistics and Chi-square (X^2) test.

Results: Result showed that 74.6% (47/63) of the female and 25.4% (16/63) of the male tested positive for GIPs. Age group 11-15 years had prevalence of 17(44.8%). The common parasites identified were *A. lumbricoides* 10(15.9%), *T. trichiura* 7(11.1%) and hookworm (*Ancylostoma duodenale*) 2(3.2%). The educational level prevalence of 10(52.6%) was observed among the

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primary level ($p < 0.05$). The risk factors such as: the use of drug in the last three months, hand washing with soap after using the toilet and washing of hands after contact with soil had significance of $p < 0.05$ while putting on foot wear outside the house $p > 0.05$.

Conclusion: The distribution of gastrointestinal parasitic infections is high among the children. Necessary treatment intervention safety measures should be routinely carried out to reduce the spread to zero tolerance.

Keywords: Gastrointestinal parasitic infection; risk factors; children home; Port Harcourt.

1. INTRODUCTION

"Gastrointestinal infections are endemic worldwide and have been described as constituting the greatest single worldwide cause of illness and disease" [1]. "It has been estimated to affect about 3.5 billion people globally and caused morbidity in approximately 450 million people" [2]. "Infections are mainly transmitted via ingestion of water, soil, or food contaminated by feces containing the cysts of protozoans or eggs/larvae of helminths" [1]. "Most common among the intestinal helminths are *Ascaris lumbricoides*, hookworms, *Trichuris trichiura*, and *Strongyloides stercoralis*. About 1.2 billion people are estimated to be infected with *A. lumbricoides* globally while *T. trichiura* and hookworm infect up to 795 and 740 million people respectively" [3]. "They are most prevalent in regions exhibiting warm and moist climates coupled with poor sanitation and hygiene. Epidemiologically, it is well established that although individuals of all ages harbor worms, the highest rates occur among children in rural areas of the tropical and subtropical areas" [4]. "The climatic conditions in this part of the world favor the development and survival of these parasites. The high prevalence in region results in infection and diseases that are the immediate causes of malnutrition and death in young children" [5]. "Several pathogenic protozoan parasites are responsible for the above health issues including *Entamoeba histolytica/dispar*, *Giardia lamblia* (also known as *Giardia intestinalis* and *Giardia duodenalis*), *Cryptosporidium*, and *Balantidium coli*, which are the most common species associated with significant illnesses" [6-8]. "Climate change is predicted to influence changes in precipitation quantity, intensity, frequency, and duration and subsequently affect environmental conditions that predispose developing countries to the transmission of waterborne disease" [9].

"Orphanages are a classical example of such a scenario. Orphans always lack basic monetary and sanitary assets in their livelihood. Hence their debilitated lifestyle makes them susceptible

to infections. Overcrowded places with a lack of cleanliness like orphanages are most dangerous as the infection spreads through them swiftly leading to multiple infections" [10]. "Orphans are the most vulnerable part of this group and they need the maximum support from the government. Records show that a global estimate of 162 million under-five years old children are documented to be stunted, 99 million underweight and 51 million wasted" [11].

The overall prevalence rate of gastrointestinal parasitic infections in Port Harcourt ranges from 24.8-46.1% [12-14], due to varying geographical conditions. The common gastrointestinal parasites isolated in these studies are *A. lumbricoides*, *T. trichiura*, hookworm, *Strongyloides stercoralis* and *Cryptosporidium parvum*. There is a paucity of information on the prevalence of gastrointestinal parasitic infections among inmates of orphanages of Port Harcourt. In the light of these developments, this present study was aimed at investigating the commonness gastrointestinal parasites in relation to age, gender, educational background, and risk factors associated with inmates in Port Harcourt.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted at Port Harcourt Children's Home, Borokiri, Port Harcourt town, Rivers State, Nigeria from August to October 2019. The Borokiri town is a neighborhood of the city Port Harcourt situated just south of old GRA in Rivers State, Nigeria. Coordinates for the town are latitude 4.749° N and longitude 7.035° E.

2.2 Study Design

This investigation involved a prospective study conducted on inmates of Port Harcourt children's Home. Inmates were categorized into sex and age groups. Questionnaires were given to the

inmates for information of their sociodemographic factors and personal hygiene.

2.3 Sample Size

An approximate minimum sample size of 63 was therefore estimated using the formula for a cross-sectional study as recommended by Godden [15]; $n = Z^2 p(1-p) / M^2$, where $n = n =$ sample size for infinite population, $Z = Z$ score (1.96), $p =$ Population proportion (assumed to be 50 % = 0.5) and $M =$ Margin of error (0.05).

2.4 Study Population

The study was carried out on 63 inmates (47 females and 16 males). All the inmates were informed clearly about the objective and procedure of the study and requested to sign a written consent. Research permit and ethical clearance were sought from the Rivers State Hospitals Management Board and the Rivers State Ministry of Social Welfare and Rehabilitation.

2.5 Isolation and Identification of Gastrointestinal Parasites

2.5.1 Direct smear examination for stool samples

“On a glass microscope slide, about 1-2 mg of stool was emulsified in a drop of normal saline (0.85% NaCl) on the left-hand side of the slide, and in Lugol's iodine on the right side of the slide. A cover slip was then placed on each side, and the slides were scanned under 10x and 40x objective lenses of a light microscope, as required. Saline direct smear is used mainly for the detection of motility of intestinal protozoan trophozoites, which are seen in liquid or semi-liquid specimens. Iodine direct smear shows the characteristic features of the diagnostic stages in more detail” [16].

2.5.2 Formol-ether sedimentation concentration technique ritchie

“Although, this formol ether technique cannot detect trophozoites, it is considered the best concentration technique used in diagnostic parasitology laboratories for the detection of cysts, ova, and larvae” [17,18]. “The Ritchie sedimentation technique was performed by emulsifying about 2 g of stool in 10-15 ml of 10% formol saline. The suspension was allowed to stand for 30 minutes, and then strained through two layers of gauze into a 15 ml conical centrifuge tube and centrifuged at 2000 rpm for 5 minutes. When needed, the washing step was

repeated until the supernatant becomes clear. The sediment was resuspended with 10 ml of 10% formal saline and allowed to stand for 5-10 minutes. A total of 3 ml of diethyl ether was added, and then the tube was shaken vigorously for 30 seconds and centrifuged at 2000 rpm for 5 minutes. After centrifugation, the fecal debris layer was loosened by a wooden stick, and the tube rapidly inverted to discard the top three layers while the sediment remained at the bottom. One to two drops of iodine were added to the sediment and mixed well. Then, part of the sediment was transferred to a microscope slide, covered with a cover glass, and scanned microscopically under low and high objective lenses” [19].

2.6 Data Analysis

The data collected from the study area were entered in Microsoft office excel 2016 before being imported to SPSS version 23 and were employed for data entry and statistical analysis. Descriptive statistics were mainly used to describe the characteristics of the study population including the prevalence of the GIPs. Qualitative data were determined and presented as frequencies and percentages. Statistical significance of differences in proportions was evaluated by the Chi-Square test with a significant value of $p < 0.05$ used for all tests. Chi-square analysis was run to determine the association of variables with GIP infections.

3. RESULTS

3.1 Prevalence of Gastrointestinal Parasites among Inmates of Children's Home

Stool specimens were collected from the inmates over a period of 8 weeks. A total of 63 inmates were examined in this study with 47 females and 16 males of which 19(30.2%) were found to be infected with one or more gastrointestinal parasites species. The gastrointestinal parasite species parasitic helminths isolated were *Ascaris lumbricoides* 10(15.9%), *Trichuris trichiura* 7(11.1%), and hookworms 2(3.2%) respectively. No protozoa were isolated.

3.2 Sex-distribution of Gastrointestinal Parasites among Inmates

The distribution of gastrointestinal parasites according to gender was established, of which females had significantly more gastrointestinal

parasitic infections 13(68.4%) compared to males 6(31.6%) ($p<0.05$) (Fig. 1). The distribution of various parasite species patterns was not affected by gender.

3.3 Distribution of Gastrointestinal Parasitic Infections among Inmates According to Age Groups

In this study, a relatively high number of 17(44.8%) of the inmates of age group 11-15 years were infested with gastrointestinal parasites while the age group of 1-5 years had 2(22.2%) infected with gastrointestinal parasites ($p<0.05$). In addition to all the age groups, the predominant gastrointestinal parasites identified were *A. lumbricoides* followed by *T. trichiura* and hookworm (Table 1).

Among the participant's educational levels, the primary school children had the most prevalent cases of gastrointestinal parasites (52.6%) followed by secondary school children and the pre-school age with statistical significance ($p<0.05$) (Table 2).

3.4 Gastrointestinal Parasites and Possible Risk Factors

The risk factors associated with gastrointestinal parasites were examined. These factors included the use of drugs in the last three months, hand

washing after toilets, footwear, and washing hands after contact with soil.

3.4.1 The use of the drug in the last three months and its association with gastrointestinal parasites

We investigated the effects of some hygienic practices like the use of drugs in the last three months. Inmates who took their drugs in the last three months were shown to be more parasitized 14(36.8%) compared to those who did not though were also parasitized. These were found to be significant ($p<0.05$) (Table 3).

3.4.2 Hand wash after visiting toilets and its association with gastrointestinal parasites

The effects of hand washing were considered, whether they were washing their hands after visiting the toilet. The inmates who claimed to wash their hands after toileting were found more infected 17(34.0%) compared to inmates who were infected and did not regularly wash their hands. These variations were statistically significant ($p<0.05$) (Table 3).

3.4.3 Footwear and risk of infection with gastrointestinal parasites

We further endeavored to examine the effect of wearing shoes on gastrointestinal parasite

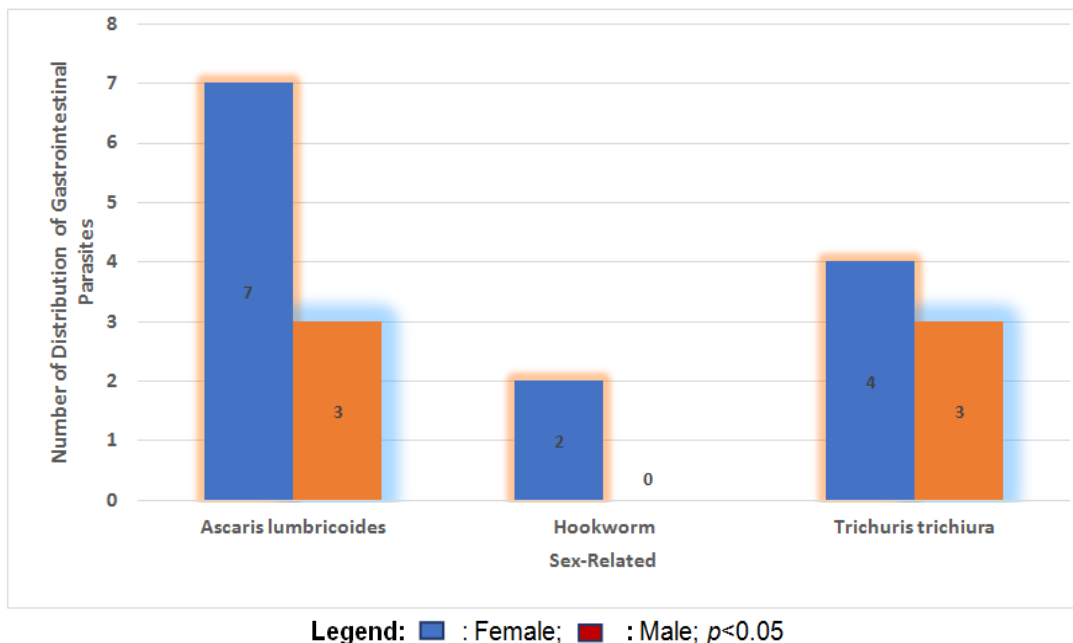


Fig. 1. Sex-related distribution of gastrointestinal parasites

Table 1. Age-related distribution of gastrointestinal parasites

Age	Distribution of gastrointestinal parasites						p-value	Chi - square (X ²)
	AL N (%)	HK N (%)	TT N (%)	Negative cases N (%)	Positive cases N (%)	Total examined N (%)		
1 - 5yrs	2(22.2)	0(0.0)	0(0.0)	7(77.8)	2(22.2)	9(100.0)	0.005	10.799
6 - 10yrs	0(0.0)	0(0.0)	0(0.0)	3(100.0)	0(0.0)	3(100.0)		
11 - 15yrs	8(21.1)	2(5.3)	7(18.4)	21(55.2)	17(44.8)	38(100.0)		
16 - 20yrs	0(0.0)	0(0.0)	0(0.0)	10(100.0)	0(0.0)	10(100.0)		
36 - 40yrs	0(0.0)	0(0.0)	0(0.0)	3(100.0)	0(0.0)	3(100.0)		
Total	10(15.9)	2(3.2)	7(11.1)	44(69.8)	19(30.2)	63(100.0)		

Legends: A.L: - *Ascaris lumbricoides*; HK: - Hookworm; TT: - *Trichuris trichiura*; p<0.05

Table 2. Educational level and distribution of gastrointestinal parasites

Education_ level	Distribution of Gastrointestinal parasites						p-value	Chi square (X ²)
	AL N (%)	HK N (%)	TT N (%)	Negative cases N (%)	Positive cases (%)	Total N (%)		
Non-Educated	0(0.0)	0(0.0)	0(0.0)	3(100)	0(0.0)	3(100)	0.008	12.438
Pre-School age	2(22.2)	0(0.0)	0(0.0)	7(77.8)	2(22.2)	9(100)		
Primary	6(31.6)	0(0.0)	4(21.1)	9(47.4)	10(52.6)	19(100)		
Secondary	2(6.9)	2(6.9)	3(10.3)	22(75.9)	7(24.1)	29(100)		
Tertiary	0(0.0)	0(0.0)	0(0.0)	3(100)	0(0.0)	3(100)		
Total	10(15.9)	2(3.2)	7(11.1)	44(69.8)	19(30.2)	63(100)		

Legends: AL: - *Ascaris lumbricoides*; HK: - Hookworm; TT: - *Trichuris trichiura*; p<0.05

Table 3. Association between Risk factors and gastrointestinal parasites

	Distribution of Gastrointestinal parasites						p-value	Chi-square (X ²)
	AL N (%)	HK N (%)	TT N (%)	Negative Cases N (%)	Positive Cases N (%)	Total examined N (%)		
Use of drug in the last three months								
Yes	10(26.3)	0(0.0)	4(10.5)	24(63.2)	14(36.8)	38(100)	0.003	10.764
No	0(0.0)	2(8.0)	3(12.0)	20(80.0)	5(20.0)	25(100)		
Total	10(15.9)	2(3.2)	7(11.1)	44(69.8)	19(30.2)	63(100)		
Handwashing with soap								
Yes	8(16.0)	2(4.0)	7(14.0)	33(66.0)	17(34.0)	50(100)	0.033	2.156
No	2(15.4)	0(0.0)	0(0.0)	11(84.6)	2(15.4)	13(100)		
Total	10(15.9)	2(3.2)	7(11.1)	44(69.8)	19(30.2)	63(100)		
Putting on shoes outside								
Yes	10(16.7)	0(0.0)	7(11.7)	43(71.6)	17(28.4)	60(100)	0.079	12.794
No	0(0.0)	2(66.7)	0(0.0)	1(33.3)	2(66.7)	3(100)		
Total	10(15.9)	2(3.2)	7(11.1)	44(69.8)	19(30.2)	63(100)		
Washing hands after contact with soil								
Yes	10(20.8)	2(4.2)	4(8.3)	32(66.7)	16(33.3)	48(100)	0.006	5.242
No	0(0.0)	0(0.0)	3(20.0)	12(80.0)	3(20.0)	15(100)		
Total	10(15.9)	2(3.2)	7(11.1)	44(69.8)	19(30.2)	63(100)		

infections among the inmates. Among those who were infected and had their feet covered with shoes 17(28.4%) while other infected inmates do not cover their feet 2(66.7%). These differences were not statistically significant ($p>0.05$) (Table 3).

3.4.4 Washing hands after contact with soil and risk of infection with gastrointestinal parasites

In addition, the effect of washing hands after contact with soil on gastrointestinal parasitic infections among the inmates was scrutinized. Among those who were infected washed their hands after contact with soil 16(33.3%) while other infected inmates did not wash after contact with soil 3(20.0%). These were statistically significant ($p<0.05$) (Table 3).

4. DISCUSSION

The incidences of gastrointestinal parasitic infection due to the triad of *A. lumbricoides*, *T. trichiura*, and hookworms as observed in this study have been reported among children by various authors from different parts of the country [20-23]. The study revealed that, the overall occurrence of the associated gastrointestinal parasitic infection was 30.2%. The prevalence rate of gastrointestinal parasites among

orphanages varies with different geographical locations. In Ebonyi, Plateau, Edo, and Anambra States, the prevalence of 27.9%, 24.6%, 20.7%, and 13.8% were observed by Achi et al. [24], Okolo and John [25], Nwaneri and Omuemu [26] and Oluboyo et al. [27] respectively. These prevalence rates appeared to be relatively lower than the prevalence rate recorded in this study. On contrary, Al-Shibani et al. [28] had a higher prevalence rate of 62.7% in Sana'a City, Yemeni. This difference in prevalence rate could be a result of unhygienic habits practiced by these children and lack of care and food handling from some of their attendants.

The overall prevalence according to gender among the inmates, females had significantly more gastrointestinal parasitic infections 13(68.4%) compared to males 6(31.6%) and the difference was statistically significant ($p<0.05$). This observation confirms unequal exposure to helminth eggs among the study population indicating more female susceptibility to gastrointestinal parasitic infections. However, the higher prevalence of gastrointestinal parasitic infections in female children was an indication of poor personal hygiene among the females. This was maintained by a previous study by Hailegebrie [29], who separately reported high prevalence of gastrointestinal parasites among females than males due to their activities. On the

contrary, other studies elsewhere recorded high prevalence in males than in females in Southwest Nigeria and Southern Mali [30-32]. Prevalent rates in some studies were not significant statistically as recorded by Achi et al. [24], Abah and Arene [13], Udensi et al. [33], and Nwaneri and Omuemu [26].

Age-related prevalence was common among 11-15 years; 17(44.8%) gastrointestinal parasitic infection which was statistically significant ($p<0.05$) and then declined among the oldest age group. This report is not in accordance with studies by Okpala et al. [34], El-Nadi et al. [35] and Mekonnen and Ekubagewargies [36] whose age-related prevalence were among 2-3 years age range. The high level of physical activity exhibited by children of this age group exposes them to a greater risk of infection than the others because of their multiple routes of exposure.

Ascaris lumbricoides were found to be the most prevalent 10(15.9%), followed by *T. trichiura* and hookworm 7(11.1%) and 2(3.2%) respectively. There was a statistically significant difference among the age groups ($p<0.05$). The high prevalence of gastrointestinal parasites among the inmates reflects the level of personal/community hygiene in the living environment. The presence of *A. lumbricoides*, and *T. trichiura* observed at the home was indicative of fecal-oral transmission which may be related to proper washing of fecal contaminated hands by the children after the use of their toilets. Hookworm seen in samples was indicative of regular bare body contact with the soil by the children, through which cysts/larvae of the parasite bear through the skin and from fruits and vegetables.

With regards to the educational level of the inmates, children who had primary education were found to have a higher prevalence of GIP infections than those with secondary education. This report was found to be significant ($p<0.05$). This report agrees with the studies by Omotola and Ofoezie [37] among school children in Osun state. This could probably be due to the physical activities of this level of children.

The present study has shown that despite the use of drugs in the last three months some of the inmates still revealed high positivity with gastrointestinal parasitic infections compared to those who were not given preventive therapy. This could be because of antihelminthic resistance. Similar findings were reported in

studies conducted elsewhere in Nepal by Bhattachan et al. [38]. This could be because of a lack of monitoring during drug administration by the caregivers. This risk factor was found to be statistically significant ($p<0.05$).

In the aspects of hand washing habits inmates who claimed to carry out this activity presented gastrointestinal parasites to inmates who had no hand washing habits. This could be because of improper monitoring in the side of the caregivers. Our reports were not in connection with that carried out by Pasaribu et al [39] in Indonesia. Statistical significance of this risk factor was attained ($p<0.05$).

The practice of wearing footwear by inmates was also high with gastrointestinal parasites than those who do not put on footwear. Similar findings were reported in Malaysia by Ahmed et al. [40]. This activity was not statistically significant ($p>0.05$).

Inmates who had their hands washed after being in contact with soil were infected with gastrointestinal parasites more than inmates who had no such habits. This might be because moist soil creates an environment conducive to a high prevalence of intestinal parasites [41,42] and improper handwashing techniques were missing. This report agrees with the findings of Pasaribu et al. [39]. Statistical significance was accomplished ($p<0.05$).

5. CONCLUSION

The prevalence of gastrointestinal parasitic infection in this study was high and was significantly associated with risk factors. The methods of prevention of the infection along with chemotherapy intervention and training of caregivers on the importance of monitoring and follow-up should be adopted to interrupt transmission among the inmates Port Harcourt children's home.

ETHICAL APPROVAL AND CONSENT

Institutional ethical clearance and the research permit and authorization letter were obtained from Rivers State Hospitals Management Board (RSHMB). Before sampling, concerned authorities such as the Rivers State Ministry of Social Welfare and Rehabilitation were contacted and a request for permission was made after explaining the objective of the study. Prior to sample collection

inmates were informed clearly about the objective and procedure of the study. Participation was very voluntary, without any slightest negative consequence, and samples were collected when they fully agreed by signing informed consent. Potential inmates were told that there were no foreseeable risk or undesirable side effect during fecal sample collection and any information obtained were to remain confidential.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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