



PREVALENCE OF SOIL TRANSMITTED HELMINTHES IN CHILDREN ATTENDING PUBLIC PRIMARY SCHOOLS IN SAMARU, ZARIA, NIGERIA



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Abstract: The prevalence of geohelminth infection in children attending two public primary schools in Samaru, Zaria, Nigeria was studied, using stool samples and soil collected from various parts of the schools. The samples were analysed using formol-ether concentration method and observed under the microscope to check for the presence of the ova/eggs of geohelminthes. The overall prevalence of geohelminth eggs in soil samples was found to be 59.4% in both schools (Saidu Primary School: 26.5%; Amina Primary School: 32.8%). This is distributed as follows: eggs of Hookworm (28.1%), *Taenia* spp. (18.8%) and *Trichuris trichiura* (12.5%). The overall prevalence of geohelminth eggs in the stool samples of hundred pupils examined in both schools was 30% (Saidu Pri. School: 14%; Amina Pri. School: 16%) with distribution as follows; eggs of Hookworm (13%), *Ascaris lumbricoides* (7%), *Taenia* spp. (7%), *T. trichiura* (2%) and larvae of *Strongyloides* (1%). Children aged 5 – 9 years showed higher prevalence (16%) than those aged 10 – 14 years (14%). Prevalence of the infection was higher in males (19%) than in females (11%). The responses from questionnaires administered revealed that factors such as playing with soil, irregular hand-washing habits and infrequent use of footwear played a vital role in the transmission of geohelminthes in children.

Keywords: Geohelminthes, stool, Formol-ether centrifugation, soil, public school, Zaria

Introduction

Soil-transmitted helminthes are parasites where immature stages (eggs) require a period of development or incubation in the soil before they become infective. The commonest of such parasites are *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworm and *Strongyloides stercoralis*.

Soil transmitted helminthes are a common cause of disease in school children as a result of their eating habits, poor personal hygiene and their innate tendency to play in the dirt. Helminthes infection may or may not produce any symptom, and thus may be left untreated until serious complications develop. It is estimated that there are almost as many helminthes as there are people considering multiple infection (Odinaka *et al.*, 2015). Several studies in Nigeria on geohelminthes focused on the examination of stool samples of children and not on the soil in their schools or place of residence (Mordi and Okaka, 2009; Ogunkanbi and Sowemimo, 2014; Odinaka *et al.*, 2015). In a study in the city of Zaria, Northern Nigeria by Nock *et al.* (2003), 70% of soil sampled from a school compound harboured the eggs of geohelminths. Also, examination of soil samples collected from three primary schools in Ebenebe town, South East Nigeria, showed a high prevalence (70%) of geohelminth eggs/larvae in soils collected from behind the classroom blocks and behind the toilet, respectively (Chukwuma *et al.*, 2009).

School-aged children are at high risk of acquiring soil transmitted helminthic infections (Ogunkanbi and Sowemimo, 2014; Salawu and Ughele, 2015) due to factors such as playing with dirt, poor personal hygiene, playing in dirt or soil without the use of footwear, eating unwashed fruit and vegetables. In Nigeria, children attending public schools often have to contend with inadequate or the lack of toilet facilities, thus they are forced to relieve themselves in the surrounding of the school, surrounding bush, or refuse dump sites. Also, most of these children are not dewormed regularly; a study by Chukwuma *et al.* (2009) in Ebenebe, Anambra State, revealed that 70% of the children had never been dewormed. A serious health effect of intestinal helminthiasis is anaemia, which could also lead to reduced mental output and low cognitive capacity (de Silva *et al.*, 2003; Egwunyenga and Ataikiru, 2005; Odinaka *et al.*, 2015). Iron deficiency anaemia can occur as a result of moderate and heavy hookworm infection, and this specific kind of malnutrition is known as “hookworm

disease” (Hotez *et al.*, 2006). Helminthic infections caused by geohelminths rarely causes death but the disease burden lies more on the long lasting effects on the health of the host (Hotez *et al.*, 2006).

In this study, emphasis is made on the importance of the provision of proper toilet facilities in Nigerian public primary schools as a result of the impact it might have on the health of the pupils, especially in terms of infections spread by faecal-oral route. This study is aimed at evaluating the prevalence of soil transmitted helminthes in children attending public primary schools in Samaru, Zaria, Nigeria.

Materials and Methods

Collection of samples

One hundred (100) stool samples were collected randomly from pupils aged 6 – 14 years using clean, wide-mouthed containers with plastic screw caps. Instructions on how to collect the stool in the containers were given in clear language. The samples were collected between the hours of 8am – 10am, and were transported to the laboratory in the Department of Microbiology, Ahmadu Bello University (ABU), Zaria, for analysis. Thirty two (32) soil samples were also collected from the surroundings of both schools comprising the following places, latrine area, behind the classrooms, in front of the classrooms and in the playground. Questionnaires were also administered at the point of collection of stool samples from the pupils. The information provided include, the pupils’ bio data, their level of personal hygiene, use of footwear and playing with soil. Also, the questionnaires provided information on the places the pupils’ defaecate during school hours. The language of communication with the students is English and the local language; based on their responses the appropriate boxes were ticked.

Sample analysis

The stool samples were observed macroscopically for colour, consistency, and presence of blood or mucus. Using an applicator stick, one gram of faeces was emulsified in 4 ml of 10% formol water in a test tube, an additional three millilitres of formol water was added and mixed thoroughly by shaking (Chukwuma *et al.*, 2009). The emulsified faeces was sieved using gauze into a clean test tube and four millilitre of diethyl ether added and mixed thoroughly for twenty seconds. The suspension was then centrifuged at 3000 rpm for five minutes

(Cheesbrough, 2005). After centrifugation, the supernatant was decanted and the sediment transferred to a clean glass slide and covered with a cover slip. The slide was examined for cysts and eggs.

Five (5) grams of the soil samples was placed in a test tube containing formol water and homogenized for one minute. The suspension was then stained through a piece of wet cheese cloth placed over a funnel to remove coarse sand particles. Ether was added to the filtrate in a centrifuge tube and the mixture decanted. The sediment was placed on a clean glass slide, covered with a cover slip and examined microscopically (X10 and X40 objective lens, respectively) for ova/larvae of parasites.

Analysis of variance was carried out with (Microsoft Excel) to determine the statistical significance between the occurrence of the helminthes' ova and certain sociodemographic factors of the pupils.

Results and Discussion

The overall prevalence of soil-transmitted helminthic infection among pupils in two schools located in Samaru, Zaria, Nigeria (based on stool examination) was found to be 30%, however, between both schools, and School A had a higher prevalence of 32% while School B had a prevalence of 28%. School A has a large refuse dump adjacent to the school compound, where the pupils often defaecate thus shedding the parasites' eggs/ova into the environment. This increases the likelihood of transmission of the parasitic infections. The following geohelminthes were the most common in both

schools *Ascaris lumbricoides*, *Ancylostoma duodenale* and *Taenia* spp., while, *Trichuris trichuira* and *S. stercoralis* were absent in School A and School B, respectively. It has been reported that Ascariasis, Trichuriasis and Hookworm infection are the three major causes of STH infections in children in sub Saharan Africa (de Silva *et al.*, 2003). The ova of *Ancylostoma duodenale* was found to be highest in the stool samples examined in both schools, Hookworm infection is greatly influenced by habits such as not wearing footwear regularly. This trend was observed in the pupils of both schools, coupled with the fact that parts of the school grounds were used as toilet by the children thus, exposing them to the ova of the parasites released in the soil. Examination of soil samples collected from the surroundings of both schools revealed the presence of eggs/ova of only the following parasites, *Ancylostoma duodenale*, *Trichuris trichuira* and *Taenia* spp. In both schools, the ova of *Ancylostoma duodenale* were observed in higher numbers than the other parasites. There was a significant difference in the occurrence of the parasites' ova and eggs in the stool of the pupils. This is not unrelated to the apparent difference in the percentage occurrence of each parasite in both schools. No definite pattern was observed in both schools, this may have contributed to the statistical relevance (Table 1). Raji *et al.* (2011) also reported a significant difference in the occurrence of helminthes' ova in stool sampled from patients attending the University Sick-Bay, in Ahmadu Bello University, Zaria, Nigeria.

Table 1: Occurrence of geohelminthe eggs/larvae among pupils attending two public schools in Samaru, Zaria-Nigeria

School	No. of samples examined	No. of positive samples (%)	A. <i>lumbricoides</i>	S. <i>stercoralis</i>	T. <i>trichuira</i>	T. <i>spp.</i>	A. <i>duodenale</i>
School A	50	16 (32)	3 (18.8)	1 (6.3)	0	4 (25)	8 (50)
School B	50	14 (28)	4 (28.6)	0	2 (14.3)	3 (21.4)	5 (35.7)

Statistically significant; P < 0.05

Table 2: Occurrence of geohelminthe eggs/larvae in soil samples collected from two public schools in Samaru, Zaria-Nigeria

School	No. of samples examined	No. of positive samples (%)	<i>Trichuris trichuira</i>	<i>Taenia</i> spp.	<i>Ancylostoma duodenale</i>
School A	32	21 (65.6)	3 (14.3)	8 (38.1)	10 (47.6)
School B	32	17 (53.1)	5 (29.4)	4 (23.5)	8 (47.1)

The most common parasites ova/eggs found among the pupils examined are *Taenia* spp., *Ancylostoma duodenale* and *Ascaris lumbricoides*. The eggs of tapeworm were almost the same between the two age groups of 4 – 9 years and 10 – 14 years, respectively. It was also the highest incidence in both age groups. Both age groups are equally susceptible to tapeworm infection since its transmission is by ingesting the cysts in improperly cooked beef or pork. The children aged 10 – 14 years had higher incidence of Hookworm infection, a possible explanation for this could lie in the fact that, the older children are, the more independent they become and as such, there is less likelihood of their parents monitoring their personal hygiene. Thus, habits such as wearing of footwear might be less practised by these children and consequently exposing them to the eggs of the parasite. However, the high occurrence of *Ascaris lumbricoides* ova in the younger children (Fig. 1) could arise due to habits such as, not washing of hands before eating, and geophagia. This trend was also observed in studies by Dada-Adegbola *et al.* (2005) and Chukwuma *et al.* (2009), who reported decreasing incidence of *Ascaris* ova as the age of the children increased. As the age of the pupils increased, the occurrence of *Strongyloides* (not present in the younger age group) and Hookworm eggs increased. This trend was also observed in studies by

Ndamukong *et al.* (2000) and Widjana and Sutisna (2000), but Chukwuma *et al.* (2009) made contrary observations.

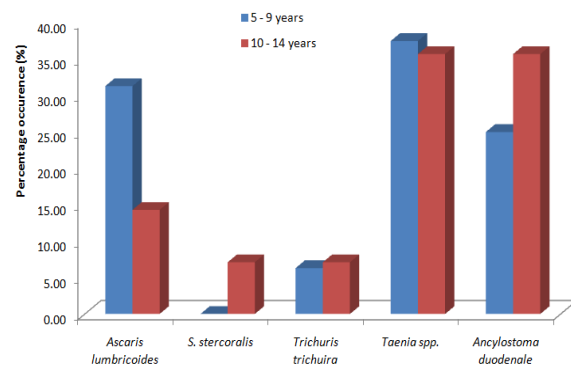


Fig. 1: Age distribution of soil-transmitted helminthes among pupils in two public schools in Samaru, Zaria (Statistically insignificant; P > 0.05)

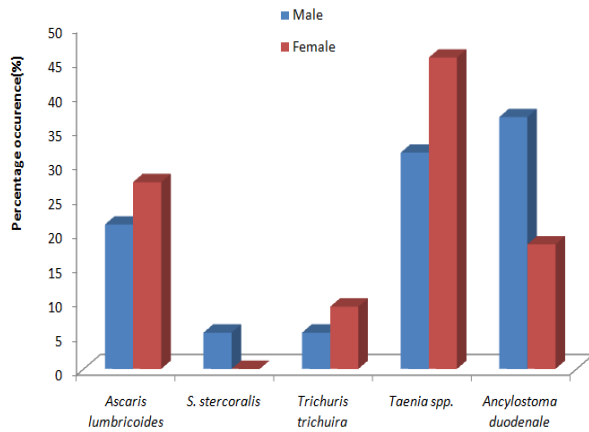


Fig. 2: Distribution of soil-transmitted helminthes based on gender among pupils in two primary schools in Samaru, Zaria (Statistically insignificant; $P > 0.05$)

The following parasites were observed to have a higher occurrence among the female pupils (Fig. 2), *Taenia spp.*, *T. trichuira* and *Ascaris lumbricoides*; while Hookworm ova was much higher among the male children. However, Chukwuma *et al.* (2009) detected a higher rate of trichuriasis among the male children; also, Ogunkanbi and Sowemimo (2014) observed a higher occurrence of *Ascaris lumbricoides* ova in preschool male children. *Strongyloides* eggs were not found in the stool of any of the female pupils.

Amongst the three parasites' eggs/ova found in the soil samples examined, those of Hookworm (52.50%) were much higher than *T. trichuira* (22.50%) and *Taenia spp.* (20.00%). Hookworm has been implicated in many studies relating to geohelminthes in children, however it isn't always the most prevalent (Mordi and Okaka, 2009; Amare *et al.*, 2013). The fact that the playground harboured the highest number of parasites' eggs compared to the classroom area than even the latrine is an indication that the playground could have been used after school hours as toilet. This is most likely to happen if the toilet provided in the school is deficient structurally, in an unhygienic state, or both, which is the case for both schools used in this study. This could also explain why the area behind the classrooms had the next highest number of parasites' eggs/ova. A study by Ogunkanbi and Sowemimo (2014) showed that indiscriminate defaecation increased the rate of ascariasis in children by 1.7 times. Interestingly, the soil around the latrine as well as soil from the area in front of the classrooms had less parasites eggs/ova. The poor state of the toilets in the schools studied and the proximity of the playground to the toilet might give the pupils cause to use the playground for defecation instead of the latrine. The primary schools used in this study are owned by the Local government and unfortunately, they do not always get the necessary financial attention required to put certain structures in good condition. It is not uncommon to find substandard or even no toilets in such schools. These appalling conditions lead to the indiscriminate defecating by the pupils in the school surroundings.

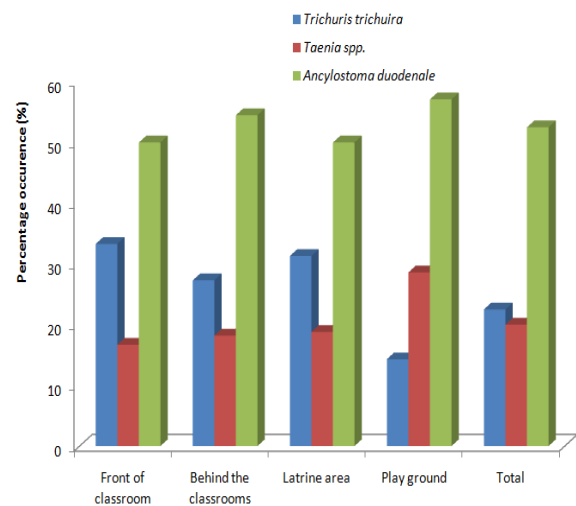


Fig. 3: Distribution of soil-transmitted helminthes in soil collected from two public schools in Samaru, Zaria; (Statistically insignificant; $P > 0.05$)

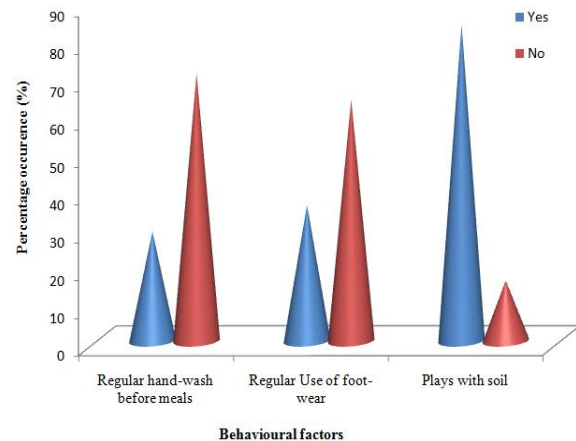


Fig. 4: Risk factors associated with transmission of helminthiasis in pupils attending public schools in Samaru, Zaria

A close look at some of the behavioural habits of the pupils in the study with relation to personal hygiene reveals that a good number of them are highly predisposed to infection with these intestinal helminthes (Fig. 4). About 80% of the pupils in both schools responded in the affirmative that they play with soil, whereas 60% – 70% of these children do not wash their hands before eating and do not use footwear. This information was obtained from the questionnaires used in the study. Their responses is a good evidence that there is a strong likelihood of the children coming in contact with the ova/cysts of these helminthes, since the parasites spend part of their lifecycles in soil.

School-aged children are classified as a high risk population in the transmission of intestinal helminth infection by World Health Organization (Hotez *et al.*, 2006) as a high percentage of these infections occur in children. It is recommended that the appropriate authorities responsible for the physical maintenance of these schools put in more efforts in ensuring that the latrines are in good condition so as to discourage defecation in the school surroundings. Deworming should also be encouraged as a regular practise for school-aged children.

Conclusion

School A had higher percentages of intestinal helminthes in both the stool and soil samples. The occurrence of the helminthes showed no particular trend with respect to age of the pupils or gender. Habits such as irregular or lack of use of footwear as well as regular hand washing seemed to play a significant role in the transmission of intestinal helminthiasis in the pupils. Parents and teachers should endeavour to instil the practise of good personal hygiene to their wards; also the provision of proper toilet facilities should be made a priority in schools.

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