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Soil transmitted helminth infections among primary school children in Ile-Ife Southwest, Nigeria: A cross-sectional study

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ABSTRACT

Helminths are the most common infectious agents of humans in developing countries producing a global burden of disease that exceeds conditions like malaria and tuberculosis. A study on the prevalence of Soil Transmitted Helminths (STH) infections and its effect was studied among primary school children aged 3 to 14 years in Ile-Ife, Osun State, Nigeria. Fecal samples of 162 (80 male and 82 female) pupils from primary school were microscopically investigated for STH. In all, 75 (46.3%) were positive for one STH while 2 pupils (1.2%) had double infection. Six STH were recorded in this study namely: *Ascaris lumbricoides* 59 (36.4%), hookworm 9 (5.6%), *Strongyloides stercoralis* 6 (3.7%), *Teania* spp. 2 (1.2%), *Schistosoma mansoni* and *Hymenolepis nana* 1 (0.6%) each. The intensity of infection based on the number of egg in 1 g of stool was categorized into severe, moderate and heavy infection. None of the children had heavy infection while 44 (27.0%) of those infected with *A. lumbricodes* had light infection and 7 (4.3%) had moderate infection. No significant difference was observed when the mean weight and height of infected and non-infected pupils were compared. The wide spread infection among the pupils is attributed to poor hygienic condition and the low socioeconomic status of these communities. The low intensity recorded is an indication that with more coordinated control efforts the parasites can be eradicated. Education on proper hygiene habits and regular de-worming exercise especially at the primary school level is recommended.

Keywords: Soil transmitted helminths, epidemiology, school children, Nigeria.

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INTRODUCTION

Soil Transmitted Helminths (STH) infection is a major health problem of children from rural areas of developing countries and it is an important cause of morbidity in school age children especially primary school pupils (4 to 15 years) who harbour the highest intensity of worm infestation (Oyibo et al., 2013; Adeyeba and Akinlabi, 2006). Five species are responsible for widespread disease in humans and these include *Ascaris lumbricoides, Trichuris trichiura, hookworm (Ancylostoma duodenale* and *Necator americanus) and Strongyloides stercoralis* (Ojurongbe et al., 2011). Approximately 2 billion people are infected with STH worldwide, which are endemic in most tropical countries; however, this might be an underestimate of the true global distribution (Albonico et al., 2008; Saboyá et al., 2013). Infection and transmission are propagated by poor hygienic habits such as indiscriminate disposal of human and animal faeces, which permits contact of faeces and its accompanying microbial load with soil or water. Generally, STH infections are associated with poverty, lack of sanitation, impaired hygiene and overpopulation (Ojurongbe, 2013).

In Nigeria, a considerable amount of human and animal wastes are discharged into the soil daily leading to the contamination of the soil with STH eggs and larvae (Adeyeba and Tijani, 2002). Infection may be direct or

indirect through secondary sources such as food, water, vegetables and fruits since most STH infections are acquired through the faecal-oral route. Observations in Zaria, Northern Nigeria showed that 70% of the soil samples collected in a school compound were contaminated with STH eggs showing the level to which the soil can be contaminated with faeces (Nock et al., 2007).

The risk of the individuals suffering from STH infection-related morbidity appears to be a joint function of the number of species harboured and/or the infection intensity of any species (Mukhopadhyay et al., 2008). Other significant morbidities attributed to intestinal helminthiasis include malnutrition, growth retardation, anemia, vitamin A deficiency and impaired intellectual performance (Hotez, 2011; Ojurongbe, 2013). The relationship between malnutrition and geo-helminth infection which has been well established is complex and depends on determinants such as the social, economic and physical environments in which an individual lives. STH are recognized as major public health problems, because they negatively affect the host's nutritional status by affecting the intake, intestinal absorption, metabolism and excretion of nutrients (Stephenson et al., 2000). The objectives of this study therefore were to determine the prevalence and burden of STH infections among primary school children in Ile-Ife, Osun state Nigeria.

SUBJECTS AND METHODS

Study area

The study was conducted in four communities (Asipa, Ipetumodu, Yakooyo and Moro) within Ipetumodu, Ife-North Local government area in Ile-Ife, Osun state, Nigeria. This area is a typical tropical environment consisting mainly of Yoruba-speaking ethnic group. Five rural primary schools were selected within these communities for the purpose of the study.

Study subjects and sampling technique

This cross-sectional study was conducted in five rural primary schools. The schools were selected for the study using simple random sampling technique. The purpose of the study was explained to the participants and their parents/guardian and teachers. Consenting pupils were then selected into the study. Ethical approval was sought and obtained from Ife-North Local government education board ethical committee.

The age of each child was determined based on the school records, and the weight and height were measured. Containers for fecal samples were given and careful explanation on proper collection was given to all the pupils. The samples were collected the following day. The appearance of each fecal sample was carefully examined for colour, consistency, blood, mucus and presence of adult worms. The stools were microscopically examined using direct method and formol-ether concentration for presence of parasite eggs in stool. Intensity based on number of eggs in approximately 1g of stool was categorized into light (1 to 4999 epg for *A. lumbricoides*, 1 to 1999 epg for hookworm, *T. trichuria* and *S. mansoni*), moderate (5000 to 9999 epg for *A. lumbricoides*, 2000 to 3999 epg for hookworm, 1000 to 9999 epg for *T. trichuria* and 100 to 399 epg for *S. mansoni*) and heavy (>10000 epg for *A. lumbricoides*, >4000 epg for hookworm, >10000 epg for *T. trichuria* and >400 epg for *S. mansoni*) (Aboyá et al., 2011).

Statistical analysis

Data analysis was carried out using SPSS version 16. Frequency tables and cross tabulations were produced for each of the study variables. Relationship between independent and dependent variables was assessed using chi-square test. Statistical significance was achieved if $P < 0.05$.

RESULTS

Fecal samples of 162 (81 male and 81 female) primary school pupils' ages 3 to 15 years were microscopically examined for STH. In all, the total prevalence of intestinal helminth in the study population was 75 (46.3%) and double helminth infection was 2 (1.2%). The mean height and weight of the pupils were 16.48 ± 8.86 m and 116.31 ± 16.35 kg, respectively (Table 1). Six species [*Ascaris lumbricoides* 59 (36.4%), hookworm 9 (5.6%), *Strongyloides stercoralis* 6 (3.7%), *Teania* spp. 2 (1.2%), *Schistosoma mansoni* and *Hymenolepis nana* 1 (0.6%)] of helminths were recorded in the study. Table 2 shows the distribution of intestinal helminth based on sex and age. Males 46 (28.4%) had a higher prevalence compared to the female 32 (19.8%) counterparts but the difference was not statistically significant. The prevalence of infection according to age groups revealed that age group 7-10 years had the highest prevalence 41 (25.3%) of helminth infection but the difference was not statistically significant (Table 2). Table 3 shows the intensity of infection in the study population. The intensity is calculated based on WHO guideline. Intensity could not be calculated for parasites (*S. stercoralis*, *Taenia* spp. and *H. nana*) not listed by WHO. None of the children had heavy intensity of infection while 27% of those infected with *A. lumbricoides* had light intensity and 4.3% had moderate intensity of infection (Table 3).

The comparison between age, weight and height of infected and uninfected children in relation to intestinal helminth infections are shown in Table 4. The mean weights of infected children (19.93 kg) were lowered compared to uninfected children (20.62 kg) but the difference was not statistically significant. The mean height of infected children (118.22 cm) was slightly higher than those of uninfected children (117.67 cm), and the difference was also not statistically significant ($P > 0.05$).

DISCUSSION

The result of this study confirmed the fact that STH is still prevalent among school children in rural communities of Nigeria (Damen et al., 2010; Brooker et al., 2006). STH

Table 1. Characteristics of children and schools.

Characteristics	n = 162	Percentage (%)	
Age group			
3-6	57	35.2	
7-10	84	51.9	0.33
11-14	19	11.7	
Sex			
Male	81	50	0.57
Female	81	50	
Mean weight (kg)	16.48 ± 8.86	Not applicable	
Mean height (m)	116.31 ± 16.35	Not applicable	
No. positive for helminths	75	46.3	
No. positive double helminths	2	1.2	

Table 2. Prevalence of Intestinal helminth by age and sex.

Characteristics		No. examined	No. positive (%)					
			AL	HW	SS	Taenia spp.	SM	HN
Sex	Male	81	34 (42.0)	6 (7.4)	3 (3.7)	2 (2.5)	0 (0.0)	1 (1.2)
	Female	81	25 (30.9)	3 (3.7)	3 (3.7)	0 (0.0)	1 (1.2)	0 (0.0)
Age (yrs)	3-6	57	21 (36.8)	3 (5.3)	4 (7.0)	1 (1.8)	2 (3.5)	0 (0.0)
	7-10	86	32 (37.2)	6 (7.0)	2 (6.3)	0 (0.0)	0 (0.0)	1 (1.2)
	11-14	19	6 (31.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total		162	59 (36.4)	9 (5.6)	6 (3.7)	2 (1.2)	1 (0.6)	1 (0.6)

Table 3. Prevalence and intensity of intestinal helminth infection among primary school children.

Helminths (n = 163)	Prevalence	Intensity class		
	No. of cases (%)	Light (%)	Moderate (%)	Heavy (%)
A. lumbricoides	59 (36.4)	44 (27.0)	7 (4.3)	0 (0)
Hookworm	9 (5.6)	9 (5.5)	0 (0)	0 (0)
S. mansoni	1 (0.6)	0 (0)	1 (0.6)	0 (0)
S.stercoralis	6 (3.7)	NA	NA	NA
H. nana	1 (0.6)	NA	NA	NA
Taenia spp.	2 (1.2)	NA	NA	NA
A. lumbricoides + *S. stercoralis*	1 (1.2)	NA	NA	NA

Key: NA – Not Applicable: Value for calculation not available in WHO criteria.

Table 4. Comparison between age, weight and height-related prevalence of intestinal helminth infections among school children.

Parameter	Positive (n = 72)	Negative (n = 91)	*p*-value
Mean age ± SD	7.94 ± 2.50	7.73 ± 2.48	0.587
Mean weight ± SD	19.93 ± 4.90	20.62 ± 7.06	0.485
Mean height ± SD	118.22 ± 13.21	117.67 ± 15.31	0.812

infections, malnutrition and anemia still ranked high among the major public health problems affecting children from rural communities due to their low socioeconomic status and social isolation (Ahmed et al., 2012). The findings of our study indicated that 46.3% of the children examined are infected with intestinal helmithiasis. This observation was similar to those previously recorded in Ibadan Oyo State Nigeria which falls within the same ecological zone as our present study area (Adeyeba and Tijani, 2002). The high prevalence reported in this study is partly due to the fact that the study was conducted in rural communities that account for high poverty rate, poor socioeconomic development and unhygienic environment that facilitate the transmission of STH.

The most prevalent helminths in this study was *A. lumbricoides* (36.4%), followed by hookworm infection (5.6%). Based on this high prevalence rate for ascarisis, this study area can be classified as high risk area for STH hence there is need for school based antihelminthic treatment in this area. Many studies have demonstrated the efficacy, acceptability and cost-effectiveness of school based control of STH infections (Leslie et al., 2011; Zani et al., 2004). Along with mass antihelminthic treatment, it is important to carry out educational awareness programs for good hygienic living among this populace. For instance the pupils normally defecate in the nearby bush surrounding the school which results in the eggs of the helminths being washed into the school compound when it rains. Most of the school children also go to school barefooted which altogether facilitate high prevalence of hookworm infections.

There is no consistent pattern attributable to gender and age group with respect to prevalence and intensity of helminth infection. The individual prevalence of intestinal helminth infection was highest among the age group 7 to 9 years old (37.2%) followed by age group 3 to 6 years old (36.8%) and then age group 11 to 14 (31.6%). No significant difference was observed between age and prevalence in the population indicating that age brackets studied are equally exposed to infection with STH. This is unexpected as the study was conducted among primary school children who have been reported to be the high risk group as far as STH transmission is concerned (Naish et al., 2004; Abera et al., 2013). While males were more infected with *A. lumbricoides*, females were found to be more infected with hookworm in this study. The result shows that the prevalence of STH is neither age nor sex dependent in this study presumably due to equal exposure to the risk factor as there were no restrictions on movement and contact of the pupils with infective egg. The overall prevalence according to gender among the pupils studied, showed that males (55.6%) generally were more infected than females (44.4%) but the difference was not statistically significant. This observation confirms equal exposure to STH among the study population.

The study has shown no significant difference between the weight and height of the pupils that were infected and uninfected with helminth infection. This might be due to the fact that the subjects in this study were asymptomatic and none of them were heavily infected. Generally, STH infection are recognized as a major contributor to malnutrition which could influence the weight and height of infected subjects (Stephenson et al., 2000). Further studies will be needed in this area to confirm this observation.

In conclusion, the findings from this study show that STH infection is highly prevalent among primary school children in Ife North Local Government Area of Osun State, Nigeria. This result supports the need for the establishment of a health programme for the control of the helminths in these communities. Mass deworming of school children coupled with health education should be implemented in this area. Also, good personal hygiene must be encouraged as well as provision of portable water and improve sewage disposal.

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