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SOIL-TRANSMITTED HELMINTHIASIS: PREVALENCE RATE AND RISK FACTORS AMONG SCHOOLCHILDREN IN ILORIN, NIGERIA

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Abstract: Prevalence rate and environmental risk factors associated with Soil-Transmitted Helminthiasis (STH) among schoolchildren in Ilorin, Nigeria were evaluated. A total of 300 primary schoolchildren aged between 5 and 12 years were recruited into the study. Two hundred and forty-six (82%) of the subjects returned suitable stool specimen which were examined for eggs of intestinal helminths. A structured questionnaire was also administered to obtain personal and risk factor information from each student. The result of the study showed that the prevalence rate of STH among the studied schoolchildren was 29.7%. Female and male pupils had a prevalence rate of 26.5% and 31.9% respectively. A large proportion of the infected subjects responded positively to practicing risk factors such as patronage of school food vendor, unhygienic eating and defecation habits, and non-use of footwear. Also defecating in the bush/open space which is one of the major routes for the spread of STH was practiced by 69.1% and 50.4% of the schoolchildren at school and home respectively. It is recommended that frequent deworming activities of schoolchildren should be merged with health education, behavioural change, and provision of safe water and effective sanitation facilities for sustainable eradication of STH.

Keywords: Environmental risk factor, soil-transmitted helminthiasis, schoolchildren

INTRODUCTION

The high prevalence of water and sanitation related diseases including Soil-Transmitted Helminthiasis (STH) exist in many countries causing many people (children in particular) to fall ill or even die [1]. STH, commonly known as intestinal worm-infection indicates infection of man by species belonging to either the nematodes (roundworm) or platyhelminth (flatworm) phylum [2]. Children that are chronically infected with the three major soil-transmitted helminths; roundworms (*Ascaris lumbricoides*), whip worms (*Trichuris trichiura*), and hookworms (*Necator americanus* or *Ancylostoma duodenale*), usually have impairments in physical, intellectual, and cognitive development [3].

Reported incidences of STH are enormous across the globe. The World Health Organization [4] estimates that 2.3 billion people in tropical and sub-tropical regions of the world are exposed to infection by hookworms, roundworms and whipworms. Children between the ages of 5 and 15 years usually have the highest rates of infection, particularly in developing countries where poverty, poor nutrition, inadequate sanitation and potable drinking water, and insufficient healthcare prevail [5]. A total of 89.9 million African school-aged children are infected with any species of soil-transmitted helminths and forty four per cent of the infections are concentrated in Nigeria, the Democratic Republic of Congo, South Africa and Tanzania [6]. In 2009, the total number of children across the world in need of preventive chemotherapy against soil-transmitted helminth infections was estimated as 882.5 million while more than 314 million children were actually treated for STH [7].

It is widely accepted that treatment methods such as deworming can decrease the menace of soil-transmitted helminths. This facilitated the passing of Resolution 54.19 at the 54th World Health Assembly in 2001 which aim to achieve 75% of deworming among school age children by 2010. However, re-infestation can occur after sometime if risk factors initiating and perpetuating the continued spread of helminthic infection are prominent. For example Roy *et al.* [8] reported how about 66% of dewormed subjects had re-infestation within 3 months of treatment. Therefore the identification of risk factors initiating and perpetuating the continued spread of helminthic infection is of paramount importance. The result of some studies suggests that chemotherapy, education, behavioral changes, access to safe drinking water and sanitation are important factors to be considered in order to decrease the burden of soil-transmitted helminths [9-12].

Therefore assessment of the prevalence rate of STH together with risk factors in a neighborhood is of prime importance for sustainable eradication of STH. Over the years, several studies abound on intestinal helminthiasis in Nigeria and local results reveal various prevalence rates from hospital based studies [13-18]. However, none of these studies have attempted to assess the socio-cultural and environmental risk factors associated with the prevalence of STH. This present study therefore sets out to assess the prevalence of STH and the associated risk factors among schoolchildren in Ilorin, Nigeria.

MATERIALS AND METHODS

The study is a descriptive cross sectional survey conducted over a four month period in Ilorin metropolis, a typical urban city in north central Nigeria. The climatic condition of Ilorin is that of tropical continental region; the mean annual temperature, relative humidity and annual rainfall is about 27°C, 76% and 1,800 mm respectively [19]. The town has pipe-borne water that is supplied erratically on some days of the week with augmentation from other sources such as well, streams and bore-holes. Most of the homes have pit latrines and water closets which are used by both adults and children [20]. There are several private and public primary schools in Ilorin and some of these schools serve communities that have high prevalence of diseases related to inadequate water supply, sanitation and hygiene [21]. Hence, the socio-cultural, climatic and environmental conditions of Ilorin seem favorable to sustain the growth of helminths and spread of STH.

The study population consists of primary schoolchildren aged between 5 and 12 years from five different schools. Schoolchildren who had taken anti-helminthic drugs within 6 months preceding the study were excluded from the study. Multistage sampling technique was employed in selecting subjects for the study. Selection of schools was done by a simple random sampling technique. Selection of classes in each school was done by a proportionate sampling technique while selection of pupils was done by systematic random sampling. In all, a total of 300 primary schoolchildren who met the aforementioned criteria were used for the study.

A structured questionnaire was used to obtain socio- demographic characteristics such as age, sex, level of education of the parents, socio-economic status, hygiene practices and risk factors associated with STH both at home and school. Anthropometric measurements (*i.e.*, weights and heights) were performed on each subject. Fresh stool sample was collected using precoded specimen bottles. Samples were analyzed within an hour of collection or preserved using 10% formol saline when immediate analysis was not possible. Each stool sample was microscopically examined using saline and iodine preparations and formyl ether for the identification of infection from parasite species following the procedure of [22] and [23].

RESULTS AND DISCUSSION

General characteristics

Out of the 300 schoolchildren recruited for the study, a total of 246 (82%) returned with suitable stool specimen. Of the 246 children, 102 (41.5%) were males and 144 (58.5%) were females. Table 1 shows that the mean age of males is 9.2 years while the mean age for females is 8.7 years and the difference was not statistically significant ($p = 0.08$). The mean weight of the study population is 23.3 kg while the mean height is 120.7 cm. The mean weight and height of the males and females were comparable ($p=0.7$ and 0.38 respectively). The ages of the pupils ranged from 5 to 12 years, with a mean age of 8.9 years.

Table 1: Mean age, weight and height according to sex in the studied population

Parameter	Male (n = 102)	Female (n = 144)
Age (yrs)	9.2 $\pm$ 2.07	8.7 $\pm$ 2.18
Weight (kg)	23.4 $\pm$ 5.7	23.2 $\pm$ 6.4
Height (cm)	121.5 $\pm$ 11.23	120.07 $\pm$ 12.85

Prevalence rate of STH

The prevalence rate of intestinal helminthic infections is presented in Table 2. The age group 5–7 years, 8–10 years, and 11–12 years had prevalence rate of 34.3%, 30.2%, and 23.8% respectively. A total of 26.5% tested male subjects and 31.9% females had parasitic infections in their stools. Hence it can be deduced from this study that the overall prevalence rate of STH among the studied schoolchildren was 29.7%.

Table 2: Prevalence rate of STH by age and sex

Category	Sub-category	No. of pupils examined	No. of infected students (%)
Age (years)	5 – 7	67	23 (34.3)
	8 – 10	116	35 (30.2)
	11 – 12	63	15 (23.8)
Sex	Male	102	27 (26.5)
	Female	144	46 (31.9)

The detected intestinal helminthes in the analyzed stool specimens is presented in Table 3. *Ascaris lumbricoides* had the highest prevalence rate (22%), while *Necator americanus*, *Trichuris trichiura* and *Strongyloides stercoralis* had 4.5%, 1.2% and 0.4% respectively. Four pupils (1.6%) had more than one helminth detected in their stools. The highest prevalence of helminthic infections was in the 5–7 years age group. The parasites identified in this age group were *Ascaris*

lumbricoides (22.4%), hookworm (9%) and multiple parasites (3.0%). Pupils in the age group 8-10 years had the highest prevalence rates of *Trichuris trichiura* (2.6%) and *Strongyloides stercoralis* (0.9%) infection.

Table 3: Prevalence of different intestinal helminthic infections according to age group

Helminth	Age in years			
	5-7 yrs n=67 (%)	8-10 yrs n=116 (%)	11-12yrs n=63 (%)	Total n=246 (%)
<i>Ascaris lumbricoides</i>	15(22.4)	25(21.6)	14(22.2)	54(22.0)
<i>Necator Americanus</i>	6 (9.0)	5 (4.3)	0 (0.0)	11(4.5)
<i>Trichuris trichiura</i>	0 (0.0)	3 (2.6)	0 (0.0)	3 (1.2)
<i>Strongyloides stercoralis</i>	0 (0.0)	1 (0.9)	0 (0.0)	1 (0.4)
Polyparasites	2 (3.0)	1 (0.9)	1 (1.6)	4 (1.6)
Total	23(34.4)	35(30.2)	15(23.8)	73(29.7)

Environmental Risk Factors

The information gathered on factors favoring the transmission of intestinal helminthiasis is presented in Tables 4 and 5. In most of the responses, practices that facilitate the transmission of intestinal helminth infections such as patronage of school food vendor, unhygienic eating and defecation habits, and non-use of footwear were observed more in the infected population. Passage of worm in stool was also greater in the infected population (75.3%) than the non-infected population (58.4%). As shown in Table 5, more females (70.8%) wore foot wears than males (53.9%) and the difference was significant statistically ($\chi^2=7.39$, $p=0.006$). More females ate unwashed fruits (97.9%) than their male counterparts (87.3%) which was also significant statistically ($\chi^2 = 9.47$, $p = 0.002$).

Table 4: Risk factors and response from infected and non-infected pupils

Risk factor	Response	Infected n =73 (%)	Non- infected n =173 (%)	χ^2	p
Patronage of school food vendor	Yes	71(97.3)	150 (86.7)	5.16	0.93
	No	2 (2.7)	23 (13.3)		
Eating of unwashed Fruits	Yes	69 (94.5)	161(93.1)	0.02	0.33
	No	4 (5.5)	12 (6.9)		
Hand washing after toilet use	Yes	64 (87.7)	141 (81.5)	0.18	11.33
	No	9 (12.3)	32 (18.5)		
Hand washing before eating	Yes	14 (19.2)	43 (24.9)	0.78	0.0007
	No	59 (80.8)	130 (75.1)		
Use of footwear at home	Yes	35 (47.9)	122 (70.5)	1.41	6.37
	No	38 (52.1)	51 (29.5)		
Passage of worm in stool	Yes	55 (75.3)	101 (58.4)	0.23	0.01
	No	18 (24.7)	72 (41.6)		

Other risk factors identified for the acquisition of STH like hand washing practices after toilet use, passage of worm in stool in the past, patronage of school food vendor, hand washing

practices before eating were comparable among both sexes ($p = 0.38$, 0.8, 0.8 and 0.9 respectively).

Table 5: Positive response of pupils to risk factors for helminth infections according to sex

Risk factor	Total n (%)	Male n (%)	Female n (%)	χ^2	p
Use of footwear	157(63.8)	55 (53.9)	102 (70.8)	7.4	0.006
Eating of unwashed fruits	230 (93.5)	89 (87.3)	141(97.9)	9.47	0.002
No hand washing after toilet use	205 (83.3)	82 (80.4)	123 (85.4)	0.7	0.38
Patronage of school food vendor	221(89.8)	92 (90.2)	129 (89.6)	0.02	0.8
No hand washing before eating	57 (23.2)	24 (23.5)	33 (22.9)	0.002	0.9

The distribution of excreta disposal facilities used by the pupils in the schools and at home are shown in Figure 1. A large proportion of pupils use bush/open space method both at home and in school which is one of the major routes for the spread of STH. However, more pupils used bush/open space method at home (69.1%) than in school (50.4%) ($\chi^2=17.88$ $p=0.00002$). This is an indication of the need to provide excreta disposal facilities for schoolchildren at home since a greater proportion of students' active time is spent at home.

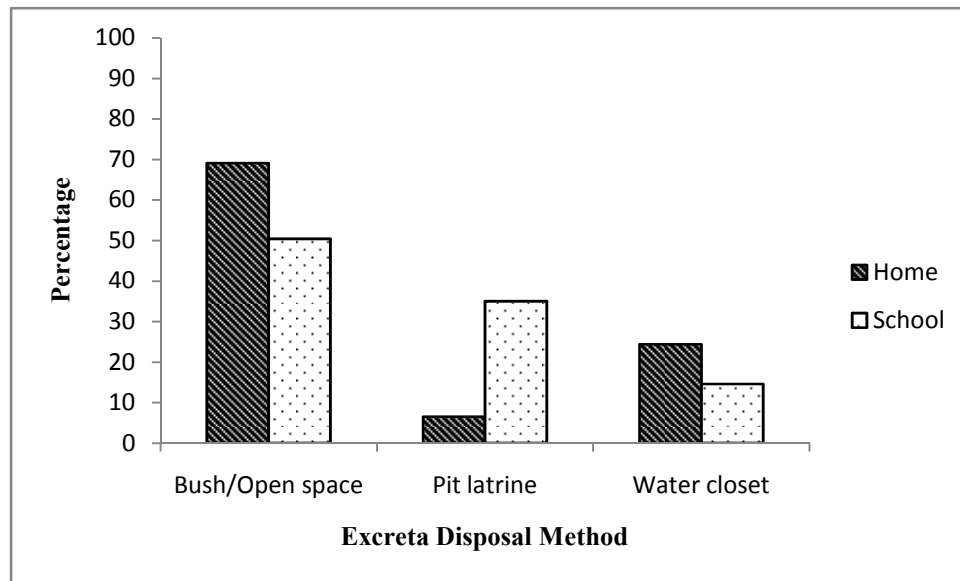


Fig. 1: Excreta disposal method utilized by the studied pupils

The proportion of pupils that frequently make use of pit latrine in school (35.0%) was higher than those that make use of this excreta disposal facility at home (6.5%). More pupils used the water closet disposal method at home (24.4%) than in school (14.6%) ($\chi^2=7.46$, $p=0.006$). The predominant use of pit latrine over water closet within the studied schools is in consonance with UBEC (2009) report [24] which indicated that 27.73% and 15.45% of primary schools in Nigeria have pit latrine and water closet respectively. More importantly inadequate water supply and poor socio-economic status might be major factors which limit the use of water closet.

CONCLUSION

The prevalence rate of Soil-Transmitted Helminthiasis (STH) among the studied schoolchildren in Ilorin, north central Nigeria was observed to be 29.7%. Female students had a higher prevalence of STH than males. The probable explanation for the higher prevalence in females is that the girl child is more exposed to potential domestic sources of transmission of these helminthes e.g. food preparation, fetching water, cleaning the surroundings, than their male counterpart. However, the influence of gender on prevalence of helminth infection is inconclusive as it may or may not play a role depending on regional and environmental factors. An analysis of the factors favoring the transmission of intestinal helminthiasis showed possible linkage between risk factors and helminth infection. A larger proportion of the pupils responded positively to practicing factors favorable for the spread of STH. More importantly, a large proportion of pupils use bush/open space method both at home (69.1%) and in school (50.4%) which tend to promote the spread of helminth infections. Based on this study, it is recommended that frequent deworming activities of schoolchildren should be merged with health education, behavioral change, and provision of safe water and effective sanitation facilities for sustainable eradication of STH.

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