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Research Article

Prevalence of Soil Transmitted Helminths Infection among Primary School Age Children in Owo Town, Ondo State, Nigeria

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ABSTRACT

Soil transmitted helminths (STHs) parasites infections are one of the major public health problems in many tropical countries including Nigeria. The design of this study was a cross-sectional survey involving only school children. Two hundred and twenty four (224) children within the age of between 5-15 years were chosen using random sampling technique from four primary schools. Data were gathered by means of questionnaire survey and laboratory parasitological examination procedures. The pupil body mass index (BMI) was measured, blood samples was assessed for hemoglobin (Hb) and pack cell volume (PCV) level while stool samples were examined for STHs infection using direct wet-mount and Formol-ether concentration methods. Of the total 224 participants examined, 113 (50.4%) were males with 54(47.8%) infection rate and 111(49.6%) female children with 59(52.2%) infection rate. Thus, the overall prevalence of infections of STHs parasites was 50.4%. The STHs parasites species identified in the school children were *Ascaris lumbricoides*, hookworm and *Trichuris trichiura* with prevalence of 25.9%, 16.1% and 2.2% respectively. The prevalence of STHs parasite infections among school children in age group 6-10 and 11-15 were 59.3% and 40.7%, respectively. *Ascaris lumbricoides* and hookworm were found as the dominant species of helminths parasites among the people.

Key words: Neglected diseases, Hookworm, Helminths epidemiology, *Ascaris lumbricoides*, *Trichuris trichiura*

INTRODUCTION

Neglected tropical diseases (NTDs) are a diverse group of communicable diseases that prevail in tropical and subtropical conditions in 149 countries of the world and affect more than one billion people. Over 1 billion people amounting to one-sixth of the world's population, suffer from one or more NTDs. These diseases cost developing countries billions of dollars every year. They mainly affect populations living in poverty, without adequate sanitation and in close contact with infectious vectors and domestic animals and livestock. Of all the NTDs and STHs infections remain significant diseases among children (USAID 2016; WHO, 2016)

Approximately 24% of the world population (about 2 billion people) is infected with STHs with high burden among poorest and most deprived communities. Among the population affected, preschool and school-age children are highly predisposed and at risk of STHs. Over 270 million preschool-age children and over 600 million school-age children live in areas where these parasites are intensively transmitted (WHO, 2016). The public health importance of STHs infections ranked highest in morbidity rate among school aged children because they are more likely to have worms' infection due to their nutritional deficiency. These infections have been shown to impact negatively on the physical fitness, cognitive and intellectual performance of children. Intestinal obstruction, anaemia, malnutrition, dysentery syndrome, fever, dehydration, vomiting and colitis are the major complications associated with STHs infections. Thus, a significant school absenteeism and poor performance among children affected with STHs (Uneke *et al*., 2006; WHO, 2016). Most importantly, STHs infections are associated with poverty, lack of sanitation, inadequate water supply impaired hygiene and overpopulation. These socio-economic factors are of great importance and influence on health of many populations (Ojurongbe *et al*., 2014; Jeffrey *et al*., 2006; Uneke *et al*., 2006).

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Among the Africa countries, Nigeria has made considerable development in structuring policies and strategies for water supply and sanitation service delivery, but till date still faces major challenges in translating these into action. According to United Nations International Children's Emergency Funds (UNICEF), not less than 70 million people, out of a population of at least 171 million lacked access to safe drinking water and over 110 million lacked access to improved sanitation in 2013 while open defecation rates at 28.5 per cent. This pose grave public health risks (6). Every year, an estimated 124,000 children under the age of five die due to diseases mostly attributed to unsafe water, sanitation and hygiene. However, lack of adequate water and sanitation are also major causes of other diseases, including respiratory infection and under-nutrition. Many schools in Nigeria lack safe private toilets and hand-washing facilities. The economic impact of poor sanitation and hygiene cost the Nigerian economy the equivalent of almost 1.3 per cent of gross domestic product (*Cheesbrough, 2009;* UNICEF, 2016).

The objective of this study was to determine the prevalence and intensity of STHs infection among primary school age children.

MATERIALS AND METHODS

The research was carried out in four public primary schools located in Owo town of Ondo State, Nigeria. The schools are Olagbegi Primary School, St Martins' Primary School, Baptist Primary School and Salvation Army Primary School. The entire class primary 1-6 students in the surveyed schools were considered as the total population of the present study. Informed consent form was given to parents through their children to seek approval and consent. The total number of students was nine hundred and forty eight (948). Of these, two hundred and twenty four (224) brought a positive consent and approval feedback from parent and were all recruited for the study. Only the students with approved informed consent were given specific instruction for sample collection, handling and avoidance of contamination of stool samples. The collected samples were transported to Federal Medical Centre, Owo for STHs screening using direct wet mount method and formol-ether concentration by standard parasitological laboratory procedure. The intensity of STHs infection per each positive sample examined were estimated by counting the mean number of eggs per gram of faeces and categorized into light (1-5), moderate (6-10) and heavy (11 and above) infection. Participants' blood sample was obtained for hemoglobin (Hb) and pack cell volume PCV) concentrations. The prevalence of STHs infection was also investigated in accordance with risk factors such as, parent occupation, water source, toilet facility, hand washing habit and picking of fallen foods. Ethical clearance was obtained from Owo Local Government Primary Education Board before the commencement of the study. Data analyses were performed using SPSS for windows version 16.0 statistical package. The prevalence of STHs was determined by Pearson chi-square (X^2) test verifying the relationship between independent factors and the outcome variables. AP values lower than 5% ($P<0.05$) was considered significant.

RESULTS

Out of the 224 respondents, 79.8% had apparently healthy weight while about 17.0% was underweight, 2.7% at risk of overweight and 0.4% overweight (Table 1).

Table 1: Respondents' weight profile

BMI percentile range	Frequency (%) n = 224
Underweight	38 (17.0%)
Healthy weight	178 (79.8%)
At risk of overweight	6 (2.7%)
Overweight	1 (0.4%)

The colours of the stool samples are expressed in Table 2 were 80.8% was of brownish colour, 18.3% yellowish and 0.9% greenish. The consistency of the stool samples was 60.3% semi formed, 29.9% formed and 9.8% was watery. However, 7.1% of the stool samples had mucus while none was stained with blood.

Table 2: Stool macroscopic study

Stool Appearance	Frequency (%) n = 224
Stool colour	
Yellowish	41 (18.3%)
Brownish	181 (80.8%)
Greenish	2 (0.9%)
Total	224 (100%)
Stool constituency	
Formed	67 (29.9%)
Semi-formed	135 (60.3%)
Watery	22 (9.8%)
Total	224 (100%)
Presence of mucus	
Mucus	16 (7.1%)
No mucus	208 (92.9%)
Total	224 (100%)
Presence of blood	0 (0.0%)

The distribution of STHs infection among the respondents is shown in table 3. Result revealed that 50.5% of the 224 respondents' stool sample examined was positive for STHs infection while 49.5% of the samples were negative for STHs infection. An overall prevalence of STHs infection among the respondents was 50.5%. Both single and double infections were observed with the prevalence of *Ascaris lumbricoides;* hookworm and *Trichuris trichiura* with infection rate of 25.9%, 16.1% and 2.2% respectively. However, among the school children screened for STHs infection, *Ascaris lumbricoides* was the most prevalent helminths (Table 4). Table 5 shows prevalence of STHs infection by age and sex distribution. Out of the pupils in age group 6-10 years, 31.9 were infected with *Ascaris,* 24.8% with hookworm and 2.7% were infected with *Trichuris.* In the group of pupils' age between 11-15 years infections rate were 25.7% for *A. lumbricoides*, 12.4% for hookworm and 2.7% for *T. trichiura.* The prevalence per sex shows that 23.0%, 21.2% and 3.5% of male pupils were infected with *A. lumbricoides,* hookworm and *T. trichiura* respectively while 34.5%, 15.9% and 1.8% of female pupils were infected *A. lumbricoides,* hookworm and *T. trichiura* respectively.

Table 3: Distribution, of STHs infection among the Respondents

STHs Infection	Frequency (%) n = 224
Infected	113 (50.5%)
Non – infected	111 (49.5%)
Total	224 (100%)

Table 4: Distribution and Prevalence of STHs infection among the Respondents

STHs	infected cases	Prevalence (%)
Single infection		
Ascaris lumbricoides	58	25.9
hookworm	36	16.1
Trichuris trichiura	5	2.2
Double infection		
Al + HW	6	2.7
AL + TT	1	0.5
Overall Prevalence Total	113	50.5

The intensity of STHs infection among the respondents is shown in table 6, where varied infection intensity was seen among respondents. Out of the infected respondents, 57.5% had *A. lumbricoides;* 37.2% with hookworm infection and 5.3% with *T. Trichiura* infection. From the respondents, 9.4%, 27.4% and 20.4% had heavy, light and moderate ascariasis infection, respectively.

Among the respondents with hookworm infections, 2.7%, 15.0% and 19.5% had heavy, light and moderate infections. However, there was no significant infection proportion seen for *T. Trichiura.* Out of the 113 respondents only 6 represented *T. trichiura* infection. Of these six, 4.4% were light and only one heavy infection.

Table 7 shows the weight profile (p-value 0.934), anemic profile (p-value 0.874 and 0.642 for hemoglobin and PCV assessment respectively) and respondents' knowledge (p-value 0.734) were not statistically significant with the prevalence of STHs infection among the respondents. However, out of the infected pupils, 79.7% have healthy weight while 16.8% were underweight while 98 (86.7%) of those infected with STHs tested anemic with hemoglobin assessment and 56 (49.6%) had low PCV. Most importantly, 95.6% of those infected with STHs had good knowledge of hygiene and sanitation.

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Table 8 shows parent occupation, water source, toilet facility, hand washing habit and picking of fallen foods related to prevalence of STHs infection among the respondents. From the table parent occupation (p-value 0.888) for mother and (p-value 0.571) for father were not statistically significant with the prevalence of STHs infection while water source (0.000), toilet facility (0.017), hand washing habit (0.015 and 0.013) and picking of fallen foods (0.008) are statistically significantly to prevalence of STHs among the respondents. This implies an association between water source, toilet facility, hand washing habits and eaten of fallen food habits on prevalence of STHs infection.

DISCUSSION

The occurrence of STHs infection due to the triad of *A. lumbricoides*, hookworms and *T. trichiura* has been reported in children by various authors from different parts of the world (WHO, 2002; de Silva et al., 2003; avioli and Albonico, 2004; Keiser, 2008; Pullan *et al*., 2014). However, inclusively, this investigation also has revealed ascariasis and hookworm infection as the two most common soil transmitted helminthes infections among the primary school pupils less than 15 years of age from the

Table 5: Prevalence of STHs infection by age and sex distribution

Characteristics		No examined	No positive (%)				
			AL	HW	TT	Total	
Age (yrs)	0-5	2	0	0	0	0	6.874/
	6-10	140	36 (31.9%)	28 (24.8%)	3 (2.7%)	67 (59.3%)	0.702
	10-15	82	29 (25.7%)	14 (12.4%)	3 (2.7%)	46 (40.7%)	
Sex	Male	113	26 (23.0%)	24 (21.2%)	4 (3.5%)	54 (47.8%)	8.602/
	Female	111	39 (34.5%)	18 (15.9%)	2 (1.8%)	59 (52.2%)	0.126

No infected (n) = 113; total no examined (N) =224; **Legend**: *Ascaris lumbricoides* – AL, hookworm – HW, *Trichuris trichiura* – TT.

Table 6: Intensity of STHs infection among the Respondents

Characteristics	STHs Intensity			
	Light infection	Moderate Infection	Heavy infection	TOTAL
Infection intensity	31 (27.4%)	23 (20.4%)	11 (9.4%)	65 (57.5%)
A. *lumbricoides* hookworm	22 (19.5%)	17 (15.0%)	3 (2.7%)	42 (37.2%)
T. trichiura	5 (4.4%)	0 (0.0%)	1 (0.9%)	6 (5.3%)
TOTAL	58 (51.3%)	40 (35.4%)	15 (13.3%)	113 (100.0%)

N (no of infected respondents) =113 N (no of respondents examined) = 224; **Legend**: *Ascaris lumbricoides* – AL, hookworm – HW, *Trichuris trichiura* – TT.

Table 7: Weight, haematology profile, knowledge, attitude and practice of hygiene/sanitation related to prevalence of STHs infection among the respondents

Index	No of respondents	No positive	χ^2/ p-value
Weight profile			
Underweight	38	19 (16.8%)	7.743/
Healthy weight	178	90 (79.7%)	0.934
At risk of overweight	6	3 (2.7%)	
Overweight	2	1 (0.9%)	
Anemia profile			
Hemoglobin/Hb (g/dl)			
Non anemic	27	15 (13.3%)	9.074/
Anemic (197)			0.874
Mild	68	31 (27.4%)	
Moderate	127	66 (58.4%)	
Severe	2	1 (0.9%)	
Hematocrit/PCV (%)			
Normal	122	57 (50.4%)	3.375/
Low	102	56 (49.6%)	0.642
Knowledge of hygiene and sanitation	209	108	2.776/
Good	15	(95.6%)	0.734
Poor		5 (4.4%)	
Reported attitude & practice of hygiene and sanitation			
Good	161	93 (82.3%)	15.689/
Poor	63	20 (17.7%)	0.004

N (no of infected respondents) =113 N (no of respondents examined) = 224.

Table 8: Parent occupations, water source, toilet facility, hand washing habit and picking of fallen foods related to prevalence of STHs infection among the respondents

Index	No examined	No positive	χ^2/ p-value
Parent occupation			
Mothers' occupation			
Farmer	16	4 (3.5%)	18.250/
Artisan	35	19 (16.8%)	0.571
Business	93	56 (49.6%)	
Civil servant	73	30 (26.6%)	
No occupation	7	2 (1.7%)	
Fathers' occupation			
Farmer	43	23 (20.4%)	
Artisan	26	13 (11.5%)	12.752/
Business	60	27 (23.9%)	0.888
Civil servant	94	49 (43.4%)	
No occupation	1	1 (0.9%)	
Water source			
Borehole/Public tap water	79	38 (33.6%)	18.669/
Well	47	25 (22.1%)	0.000
Rain + well	44	25 (22.1%)	
Rain + Borehole/public tap	32	16 (14.2%)	
Rain + stream + well	22	9 (8.0%)	
Toilet facility			
Water closet	112	53 (46.9%)	14.248/
Latrine	86	49 (43.4%)	0.017
Open defecation	26	11 (9.7%)	
Hand washing after defecation	61	38 (33.6%)	22.031/
Do wash hand always	125	59 (52.2%)	0.015
Do wash hand sometimes	38	16 (14.2%)	
Do not wash hand			
Hand washing before meal			
Yes	169	90 (79.7%)	8.892/
No	55	23 (20.4%)	0.013
Eaten of fallen food habits			
Yes	209	107 (51.2%)	3.403/
No	15	6 (40.0%)	0.008

selected schools in the studied area (Owo). Although at varying level of prevalence and intensity, the infection is widespread among infected pupils of different age.

The result of this study confirmed the fact that STHs is still prevalent among school children because the knowledge of children on hygiene in Owo, Ondo State is poor and however, not different from the poor hygiene practiced by children in many rural and semi-urban areas of Nigeria. STHs 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 as reported by Ojurongbe *et al* (4) Out of the 224 stool samples examined, majority was infected with STHs with 50.5% prevalence among the children. This observation was similar to those previously recorded in communities of Ifedore local government area (LGA) of Ondo State (Pullan *et al*., 2014), Ife East LGA (Salawu and Ughele, 2015) and Ife Southwest (Ojurongbe *et al*., 2014), which falls within the same ecological zone (Nigeria) of this present study. Reports of similar status have also been reported in studies from other neighboring States such as Moro LGA of Kwara State (Babatunde *et al*., 2013) and Ethiope East LGA of Delta State. The high prevalence reported in this study is partly due to poor socioeconomic development and unhygienic environment that facilitate the transmission of STHs.

The most prevalent helminths in this study was *A. lumbricoides* (25.9%), followed by hookworm (16.1%) while *T. trichiura* infection was of low rate (2.2%) prevalence among the respondents. Intensity of infection is the main epidemiological index used to describe STHs infection and it is very important in determination of infection outcome. This intensity is measured by the number of eggs per gram of faeces. The distribution of these eggs/larvae among infected respondents showed varied infections depending on age, location and hygiene knowledge of respondents. However, Jeffrey et al (Jeffrey *et al*., 2006) reported that on general note, STHs of moderate and high infections can produce a clinical manifestation. Previous study indicated that the highest intensity of infections is most common among the school age pupils than adults (Babatunde *et al*., 2013; Deepthi *et al*., 2014) and that morbidity from these infections are directly related to the numbers of worms harboured in the host (Deepthi *et al*., 2014; WHO, 2016).

The occurrence of STHs among primary school subjects of between 5-15 years as observed in this study is similar to the situation in several other communities in Nigeria as compared with the earlier studies of Babatunde *et al*. (14); Simon-oke *et al*. (16); Ojurongbe *et al* (4); Salawu and Ughele (13); Dada (17). Age and sex related prevalence showed that STHs infection cut across the different age and sex of subjects. However, infection was higher in female than the male subjects; this agrees with the studies of Babatunde *et al*. (14); Simon-oke *et al*. (16); Dada (17). The high prevalence among age groups in children could be attributed to the fact that children are not mindful of the health risk that is associated with playing in contaminated environment and they often spend their leisure time playing out-door. They are often in contact with soil and are found eating indiscriminately with unwashed hands (Salawu and Ughele, 2015).

The important determinant in transmission of STHs parasites is inadequate water supplies thereby making drinking water source as a risk factor in prevalence of STHs infection (Jeffrey *et al*, 2006; 5, UNICEF, 2016; WHO, 2016). In the present study, some of the pupils drink borehole/tap water, and well water. However, 33.6% of those infected with STHs had access to borehole/tap water, 22.1% to well water, 22.1% to rain/well, 14.2% to rain/borehole/tap and 9.7% to rain/well/stream water. Based on the high prevalence rate of STHs infection seen with varying intensity, the studied area can be classified as risk area for STHs infection hence there is need for helminths treatment in the area. The findings showed that there was no significant association between STHs parasite infections and parent occupation, knowledge of hygiene/sanitation ($P>0.05$). Factors like source of attitude/practice of hygiene, drinking water source, type of toilet facility, hand washing habit before meal and after toilet were significantly associated with STHs parasites infection ($P<0.05$).

Conclusions

STHs infections represent a health problem among under-fifteen aged school children of Owo town. Most STHs parasite infections represent a child health threat because of their exposure to unsafe water and poor attitude or practice of hygiene and sanitation. *A. lumbricoides* and hookworm were dominant species helminth parasites.

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