SOIL-TRANSMITTED HELMINTH INFECTIONS AMONG SCHOOL AGED CHILDREN IN LAGOS STATE, NIGERIA

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ABSTRACT

An epidemiological investigation was carried out between February to July 2017 to investigate the prevalence of soil transmitted helminths (STHs) among primary school children aged 7 – 14 years in Lagos Island and Ajeromi-Ifelodun LGAs of Lagos State. The pupils were screened parasitologically for STHs, anthropometric data which includes the height (cm) and weight (kg) of each pupil were recorded using height scale and weighing balance respectively. Furthermore, questionnaires which probed into their knowledge of cause, symptoms, predisposing factors to infection, level of hygiene and sanitation of each respondent were administered. The parasitological examination of the 413 stool samples collected showed that 132(32%) were positive for STHs. The three STHs recorded were: Ascaris lumbricoides (50%), Trichuris trichiura (23%) and hookworm (3%). Co-infections prevalence of A. lumbricoides with T. trichiura and A. lumbricoides with hookworm were 23% and 1% respectively. There was no significant difference (p>0.05) in the prevalence of STHs among males and females, the prevalence between the two LGAs was significantly different (p<0.05). Prevalence of underweight, stunting and wasting were 10, 24.2 and 19.4% respectively. Majority of sampled children indicated washing their hands before food (98.1%), washing of fruits before eating (70.8%), washing of hands after toilet (98.6%), but only 25% of them actually wash their hands properly with soap. The high prevalence and impact of STH infections among school children can be attributed to poor hygienic condition and low socio-economic status of residents in the study area. Education on proper hygiene habits and regular de-worming exercise is recommended.

Keywords: Soil transmitted helminths, School aged children, Anthropometric data, Co-infections, Wasting, Stunting

INTRODUCTION

Soil transmitted helminths (STHs) commonly known as intestinal worm-infection has been increasingly recognized as an important public health concern, infections are common worldwide in the poorest and most resource deprived communities (WHO, 2017). The common and well known five species of helminth responsible for widespread disease in humans include *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale, Necator americanus* and *Strongyloides stercoralis* (Ojurongbe *et al*., 2011). WHO (2011) estimated that 2.3 billion people in tropical and sub-tropical regions of the world are exposed to infection by hookworms, roundworms and whipworms. It is also estimated that over 267 million preschool-age children and over 568 million school-age children currently lives in areas where STHs are intensively transmitted, and are in need of treatment and preventive

interventions (WHO, 2017). STHs infections are associated with poverty, lack of sanitation, impaired hygiene and overpopulation; other risk factors include geophagia, failure to wear foot wears, having pools of water/sewage around houses (Onuoha *et al*., 2010; Ojurongbe, 2012; Phiri *et al*., 2000 Ivoke *et al*., 2017). Soil transmitted helminths are major health problem of children from rural areas of developing countries being 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 (Adeyeba and Akinlabi, 2002).

Malnutrition among children and adolescents 5 – 19 years can be assessed by calculating body mass index (BMI), and then adjusting for age to generate BMI for- age. BMI is calculated based on the weight (kg) divided by the square of the height (m^2) of the individual. BMI-forage should be presented as Z-scores based on the 2007 WHO Growth Reference (WHO GR) for children and adolescents 5 to 19 years of age (Holland, 2011). BMI is used to find out if a child is underweight, of a healthy weight, overweight, or obese.

The burden of disease from STH is mainly associated with morbidity rather than mortality, which is attributed to their chronic and insidious impact on the health and quality of life of the affected population (WHO, 2012). High intensity of infection impairs physical growth, cognitive ability and development, and are a major cause of malnutrition and lack of essential micronutrients including iron deficiency anaemia leading to poor school performance and absenteeism in children (WHO, 2012; WHO, 2017). Previous studies from Ecuador, Nigeria, China, Malaysia (Andrade *et al*., 2001; Shang *et al*., 2010; Adefioye *et al*., 2011; Ahmed *et al*., 2012) have established an association between intensities of STH infections and stunting and wasting.

Health strategy for attainment of effective parasitic disease control programme demand knowledge of the magnitude of the disease and their changes in course of time as related to ecological, cultural, behavioural and other factors (Legesse, 2008). This study therefore provides current epidemiological data with regards to prevalence of STH in Lagos Island and Ajeromi-Ifelodun Local Government Areas of Lagos State, Nigeria with the objectives of exposing the need for a mass chemotherapy and the provision of baseline data for subsequent monitoring, evaluation and control programme aimed at improving health, nutritional status and cognitive functioning of school-age children in the study areas

MATERIALS AND METHODS

Study Area: This study was carried out in a total of seven primary schools in Lagos State, three primary schools from Lagos Island LGA and four from Ajeromi-Ifelodun LGA. Lagos Island lies between latitude 6^0 27′ 50.20″N and longitude 3^0 24′ 20.89″E, made up of semi-urban settlements of about 212,700 inhabitants (NPC, 2006). It is the unique national centre for trade and commerce in Nigeria. Trading is by far the most important economic activity for the people in this area, majority of the populations in Lagos Island have access to sanitary toilets. Ajeromi-Ifelodun (which lies between latitude 6^0 27′ 19.721″N and longitude 3^0 20′ 1.878″E) Local Government Areas of Lagos state, Nigeria with population of about 687,316 (NPC, 2006). Ajeromi-Ifelodun Local Government Area is bordered in the west by two of Nigeria's biggest sea ports (Apapa Wharf and Tincan). Ajeromi-ifelodun LGA has suffered from neglect, lack of planning and over concentration of disorganised commercial activities which includes street trading. Toilet facility majorly used in the area is water closet although open bucket and pit latrine sanitary are also used.

Study Design: A cross-sectional study was conducted in seven (7) randomly selected primary schools in Ajeromi-Ifelodun and Lagos Island Local Government Areas of Lagos State to assess the prevalence of soil-transmitted helminthes infection and to determine the status of sanitation and personal hygiene among school children. The studied population consisted of 413 school children in primary 2 – 5 from the different selected schools of the sampled Local Government Areas. The classes

of school children were chosen because of their age since soil-transmitted helminths reach its maximum intensity at the age 5 – 10 years (WHO, 2011). The sample size was not pre-determined as every student in the selected classes were given an open chance of participating in the survey. However, those whom were finally included are those whose parent consented to their participation by signing the parental consent form and were able to provide their stool sample. The samples collections were carried out from February to July 2017.

Ethical Consideration: This study was approved by the ethics committee of Student Universal Basic Education Board (SUBEB), the Education Secretary and head teachers of the primary schools involved in the study. Written informed consent was obtained from the children's parent or guardian. All information obtained from the participants was treated with confidentiality, only willing pupils were allowed to participate, and were given the right to withdraw from the study at any time.

Questionnaire Survey: A semi-structured questionnaire was administered on the pupils to assess information on their demography, knowledge, attitude and practices (KAP) of soil-transmitted helminthes and basic hygiene.

Parasitological Examination: The children were given a labeled clean plastic container (with applicator stick) and a consent form. Children whose parent or guardian consented to their participation in the survey were instructed to defecate the next morning on a piece of paper to avoid contamination from the toilet environment, and then use the applicator stick to pick up a portion of the stool into the clean plastic container provided and cover it, then come with it to school. Containers from each child was properly labeled and coded against their names, the stool specimen were immediately taken to the laboratory. The collected stool samples were processed and examined using Kato-Katz technique (Katz *et al*., 1972). The sediments were examined by placing one drop each on the center of the slide covered with cover slip and they were examined, parasites were then identified. The entire preparations were examined under the microscope to identify the eggs present, the number of eggs of each species were recorded and converted into the number of eggs per gram (EPG) of feces in order to analyze intensity of infection as classified by the WHO guideline (WHO, 1998).

Anthropometric Assessment: The height (cm) and weight (Kg) of the sampled children were recorded using a height scale and weighing balance respectively. The children were measured without shoes or any other material that could affect their actual heights and weights. Weight was measured to the nearest 0.1 kg, while the height was recorded to the nearest 0.1 cm.

World Health Organization School-aged children and adolescent growth Standards (WHO AnthroPlus, Geneva, Switzerland) was used to calculate · scores and categorized underweight as a weight-for-age · -score of <−2, stunting as a height/length-for-age · -score of <−2, and wasting as a body mass index (BMI)-for-age · -score of <−2 (Shang, 2010).

Data Analysis: Data was edited during and after collection, coded, classified to adjust for any missing information, entered. Descriptive statistics were computed and categorical variables were compared using Chi-square test using SPSS statistical package and Microsoft excel package. All statistical tests were considered significant at $p<0.05$

RESULTS

A total of 413 primary school children were sampled, the study population comprised of 250 males (60.5%) and 163 females (39.5%). majority (42.4%) of the sampled population were in primary two. The dominant ethnic group was the Yorubas (57.3%) and the dominant religion was Christianity (54.7%) (Table 1).

The respondent's parents were mostly secondary school certificate holders, residing in room apartments and also having domestic animals in their compounds (Figure 1).

Table 1: Socio-demographic variables of primary school children sampled for soil transmitted helminths in Lagos State, Nigeria

Parameters	Variable	Lagos Island			Ajeromi-Ifelodun				Total
		Holy Cross	Ereko Methodist	Araromi Baptist	Layeni	L.A	Kajola	Awodi-Ora	
Sex	Male	60	42	39	27	37	25	20	250
	Female	0	30	33	18	31	26	25	163
Class	Primary 2	16	0	12	45	68	23	11	175
	Primary 3	20	34	23	0	0	28	19	124
	Primary 4	24	38	37	0	0	0	15	114
Age	6 years	10	18	16	6	7	7	7	71
	7 years	19	16	21	19	22	11	2	110
	8 years	21	22	23	19	21	17	17	140
	9 years	9	14	9	0	9	14	16	71
	10 and above	1	2	3	1	9	2	9	27
Religion	Christian	45	58	38	14	19	31	21	226
	Islam	15	12	30	31	48	20	24	180
	Others	0	2	4	0	1	0	0	7
Ethnicity	Yoruba	23	35	38	35	58	14	25	228
	Ibo	20	25	29	9	8	29	15	135
	Hausa	7	6	0	1	2	8	5	29
	Others	0	2	4	0	0	0	0	6

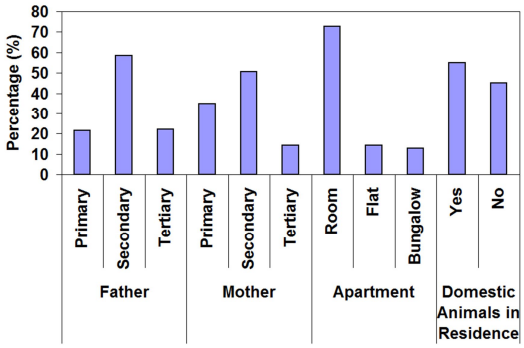

Figure 1: Educational status and living standard of parents of primary school children in Lagos State, Nigeria sampled for soil transmitted helminths

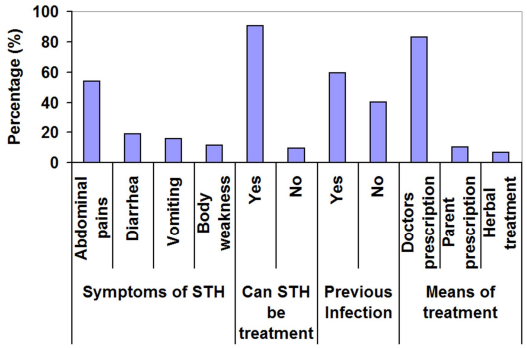

Figure 2: Perceived symptoms and means of treatment of soil transmitted helminthiasis amongst sampled children in Lagos State, Nigeria

Perceived symptoms of STHs were abdominal pains, diarrhea and vomiting. 89% of the sampled population believed that STHs can be treated. 59% of the sampled population had previously suffered the infection at least once in their lifetime. 77% of the sampled population sort treatment of STHs from health care professionals, while others depended on parent's prescription and the use of herbs for the treatment (Figure 2). 132(32%) of the sampled population were infected with at least one STH. There was no significant difference ($p>0.05$) between the prevalence of STHs by sex (Table 2).

The distribution of STHs among the sampled children indicated that *A. lumbricoides* (50%) was the most dominant STHs in the sampled Local Government Areas. Co-infection of *A. lumbricoides* with *T. trichiura* was found in 23% of the infected population, while co-infection of *T. trichiura* with hookworm occurred in 1% of the sampled population (Figure 3). Stunting was observed in 104(25.2%) of the sampled school-aged children, while underweight and wasting was observed in 41(10%) and 80(19.4%) respectively (Table 3). Majority of the sampled children indicated that they washed their hands

Table 2: School and sex prevalence of soil transmitted helminths amongst sampled school-age children in Lagos State, Nigeria

Variables	Sex	Number Examined	Number Infected	Prevalence (%)	P-value
Lagos Island	Male	141	22	15.6	0.0003
	Female	63	4	6.3	
Ajeromi-Ifelodun	Male	109	57	53.8	
	Female	100	49	46.2	
Total	Male	250	79	31.6	
	Female	163	53	32.5	0.90
	Male + female	413	132	32	

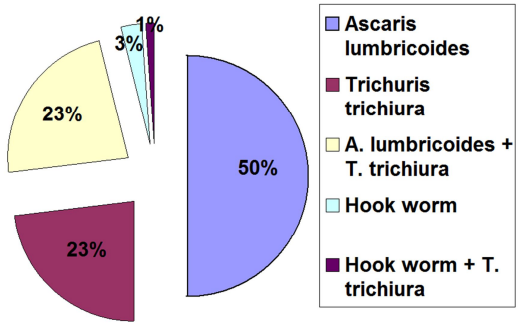

Figure 3: Distribution of soil transmitted helminths among infected sampled primary school children in Lagos State, Nigeria

before food (98.1%), washed fruits before eating (70.8%) and washed hands after toilet (98.6%). Only 25% of them washed their properly with soap (Table 4). The knowledge of STHs was high among the sampled population as about 70% claimed to have heard of the infection before, either from the health care centers, media or from the school teachers. The mode of transmission of the infection was perceived to be through contaminated food (50%), contaminated water (16%), dirty hands and fingers (16%) and geophagy (2%) (Figure 4).

DISCUSSION

Soil-transmitted helminths have been associated with poverty and are commonly found among people with poor sanitary practices, lacking adequate safe and potable water. Socioeconomic status and socio-cultural factors are significantly associated with STH infections (de Silva *et al*., 2003). Previous studies have estimated global worm burden of 39 million Disability Adjusted Life Years, lost due to intestinal helminthiasis (Chan, 1997).

Table 3: Anthropometric data of sampled school-aged children infected with soil transmitted helminths showing their nutritional status in Lagos State, Nigeria

Variable		Underweight	Stunting	Wasting
Sex	Male	26 (10.4)	68 (27.2)	51 (20.4)
	Female	15 (9.2)	36 (22)	29 (17.8)
P value		0.82	0.51	0.75
Age	6 Years	7 (9.9)	19 (26.8)	14 (20)
	7 Years	9 (8.2)	29 (26.4)	20 (18.2)
	8 Years	13 (9.3)	27 (19.3)	22 (15.7)
	9 Years	8 (11.3)	17 (24)	15 (21.1)
	10 and above	4 (15)	12 (44)	9 (33.3)
Total		41 (10)	104 (25.2)	80 (19.4)

Number in parenthesis = percentage

The results of this study have added to the available information on the occurrence and prevalence of STHs in Nigeria. High prevalence of soil transmitted helminths in Ajeromi-Ifelodun LGA and the presence of *A. lumbricoides*, *T. trichiura* and hookworm was comparable to previous reports in Southern Nigeria (Wariso and Ibe, 1994; Mafiana, 1995; Adeyeba and Akinlabi, 2002; Etim *et al*., 2002; Nock *et al*., 2003; Sam-Wobo *et al*., 2004). *A. lumbricoides* was the most prevalent STHs in this study. This was similar to earlier reports from several studies in Southern Nigeria (Ogbe and Odudu, 1990; Asaolu *et al*., 1992; Mafiana *et al*., 1998; Nworgu *et al*., 1998; Ogbe *et al*., 2002).

Table 4: Hygiene practices amongst sampled primary school children in Lagos State, Nigeria infected with soil transmitted helminths

Variable		Percentage (%)	P-value
Home toilet system	Pit latrine	33.9	0.0001
	Water closet	61.2	
	Nearby space	1.5	
	others	3.4	
Washing of hands before food	Yes	98.1	0.001
	No	1.9	
Washing of fruits before eating	Yes	70.8	0.001
	No	29.2	
Eating place	Home	87.1	0.001
	Vendor	9.1	
	Others	3.8	
Cutting of nails	<3 days	16.3	0.001
	Weekly	60.8	
	Monthly	13.4	
Washing of hands after toilet	Yes	98.6	0.001
	No	1.4	
If yes, with?	Water only	75.7	0.001
	Water and Soap	24.3	
Walking barefooted	Yes	16.8	0.001
	No	83.2	
Source of drinking water	Pipe borne	58.8	0.002
	sachet water	29.9	
Treatment of water before drinking	Yes	50.5	0.92
	No	49.5	

Helminth eggs are very resistant to harsh environmental conditions. The high prevalence of *A. lumbricoides* in the population can be associated with the ability of its egg to withstand harsh weather conditions, which may account for the widespread distribution of the eggs.

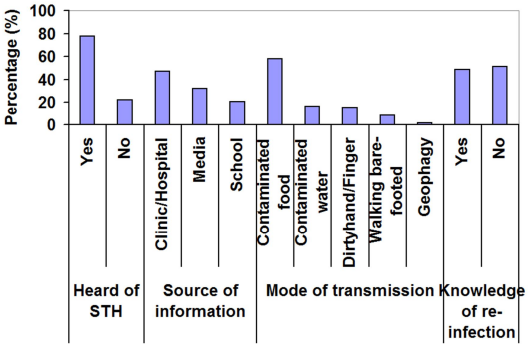

Figure 4: Knowledge, attitude and practices associated with soil transmitted helminths among sampled primary school children in Ajeromi-Ifelodun and Lagos Island Government Areas of Lagos State, Nigeria

The result of this study confirmed the fact that STH is still prevalent among school children in communities of Lagos State, Nigeria.

The high prevalence of the faeco-orally transmitted intestinal helminthes (*A. lumbricoides* and *T. trichiura*) in this study can be associated with the habits of the pupils, such as purchasing cooked meals, drinks and snacks freely from hawkers and sharing among friends and improper washing of hands after toilet. Etim *et al.* (2002) and Olsen (2003) noted that dirty hands played a major role in the transmission of ascariasis among school children.

Prevalence of STHs has been associated with locations in previous studies (Hotez *et al.,* 2006; Sumarni, 2014), similarly this study also showed that the prevalence of STHs among school aged children in Ajeromi-Ifelodun LGA was higher than among school aged children in Lagos Island LGA.

The high prevalence reported in Ajeromi-Ifelodun LGA in this study may be due to poverty, poor socioeconomic development and unhygienic environment of the sampled communities which facilitate the transmission of STHs. The most prevalent causes of helminthiasis in this study were *A. lumbricoides,* followed by *T. trichiura* and co-infection of *A. lumbricoides* and *T. trichiura.* Based on this high prevalence rate for STH, these study areas can be classified as high risk area for STH hence there is need for school based antihelminthic treatment in the area.

Previous studies have demonstrated the efficacy, acceptability and cost-effectiveness of school based control of STHs (Zani *et al*., 2004; Leslie *et al*., 2011; Edelduok *et al*., 2013).

Malnutrition is still a major public health problem in poverty ridden areas of developing countries; and wasting and stunting indicate chronic state of nutritional stress (Shang *et al*., 2010). Children being underweight and wasting have also been linked to malnutrition. In this study, stunting prevalence was 25.2% and similar to previous reports from Kenya (Shang *et al*., 2010; Suchdev *et al*., 2014). There was no significant difference in the prevalence of stunting between males and females, similar to previous study by Shang *et al*. (2010), whereas previous studies in Malaysia and Indonesia have indicated sex as a risk factor in stunting (Agho *et al*., 2009; Ahmed *et al*., 2012). Ten percent of the sampled children in this survey were underweight. This was similar to the 11.4% reported in Kenya by Suchdev *et al*. (2014) but lower to the 26.9% reported in Malaysia by Ahmed *et al*. (2012), while wasting of 19.4% recorded in this study was higher than previous prevalence in both Kenya and Malaysia (Shang *et al*., 2010; Ahmed *et al*., 2012).

The level of malnutrition recorded in this study may be linked to the low socioeconomic status of several of the households within the sampled communities. Low socioeconomic status can affect dietary intake as a result of the low purchasing power which can be related to poverty (Guan and Han, 2019).

There was high knowledge regarding STHs as more than half of the children know about STH and just few of them have low knowledge. This could mean that pupils are taught science subjects and were taught about intestinal worms by their teachers. High intensity of STH infection has been implicated with impaired physical growth, reduced cognitive abilities and development; and are a major cause of malnutrition and lack of essential micronutrients including iron deficiency anaemia leading to poor school performance and absenteeism in children (WHO, 2012; WHO, 2017).

Globally, a lot of efforts are made to reduce STHs infection (Toan, 1998; Gwatkin and Guillot, 2000; Montresor *et al*., 2002; WHO, 2002; Kabatereine *et al*., 2005). For Nigeria, it is suggested that regular treatment of school age children and other risk groups such as pre-school children, pregnant women and special occupational groups may help in avoiding the worst effects of infection, despite the absence of improved safe water supply or sanitation.

Along with mass antihelminthic drug administration, it is important to carry out educational awareness programs for good sanitary practices and hygienic living among school aged children in Lagos. Hygiene practices such as washing of hands properly especially after using the toilet, regular cutting of fingernails and regular use of foot-wears (WHO, 2012; WHO, 2017) should be encouraged.

Conclusion: Elimination of STH infections among primary school aged children in Lagos State is achievable through an integrated approach which include public health education, mass deworming activities, improved sanitation targeted at standard health practices and reduce risk factors for transmission of STH are put in place.

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