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Prevalence of soil-transmitted helminths among school-aged pupils in three selected Community Primary Schools in Etche Local Government Area, Rivers State, Nigeria.

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Abstract

Soil-transmitted helminths pose significant public health concerns, particularly among school-aged children in resource-constrained settings. This study aimed to investigate the prevalence of soil-transmitted helminths among school-aged pupils in three selected Community Public Primary Schools, Etche Local Government Area, Rivers State, Nigeria. A cross-sectional study was conducted, involving 150 school-aged pupils (1-14 years old) from three Community Primary Schools which included State School 1, State School 2, and Community Primary School, all in Etche. A structured questionnaire was administered to gather information on socio-demographic factors. Stool samples collected from each pupil were examined using the Kato-Katz technique and the STH parasites identified with keys. The overall prevalence of soil-transmitted helminth infection in the three selected schools in this study was 46%. Results obtained from this study according to sex showed that more males (52%) were infected than females (40%). Children between 5-7 years were the most infected in State School 2 and Community Primary School; while children between 12-14 years were the most infected in State School 1. Also, this study revealed that children in State School 2 had the highest soil-transmitted helminths infection (56%); while State School 1 recorded the least infection rate (34%). In this present study, *Strongyloides stercoralis* was the least prevalent soil-transmitted helminths while *Ascaris lumbricoides* (36) was the most occurring parasite in this study. There was no association ($p>0.05$) between age and gender and the prevalence of the parasite infection. A comprehensive control programme should be implemented in the area to curb the spread of infection.

Keywords: Egg; Infection; Intestine; Larvae; Parasite; Helminths

1. Introduction

Soil-transmitted helminths (STHs) are a group of intestinal parasites causing human infection through contact with parasite eggs or larvae that thrive in warm and moist soil and belong to the class Nematoda, which includes roundworms (*Ascaris lumbricoides*), whipworms (*Trichuris trichiura*), and two hookworms (*Ancylostoma duodenale* and *Necator americanus*) [1]. Soil-transmitted helminths are worms inhabiting the intestine of their host in which their immature stages require a period of development or incubation in the soil before they become infective. The soil-transmitted helminths together present an enormous infection burden on humanity amounting to 135,000 deaths every year and persistent infection of more than two billion people. The most common and well-known parasites are *A. lumbricoides*, Hookworms, *T. trichiura*, and *S. stercoralis* [2].

The prevalence of infection with soil-transmitted parasites is approximately one billion people worldwide with school children being the most heavily infected group. It is estimated that over one billion people are infected with *A. lumbricoides*, 800 million with hookworm, and 770 million with *T. trichiura* [3]. Nigeria is endemic for helminthic

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infections, with preschool and school-aged children (0–15 years) among the groups that are at greater risk of getting infected [4, 5]. Savioli *et al.* [6] had previously stated that school-aged children are more vulnerable to infestation due to their poor hygiene practices and play habits which bring them in close contact with contaminated soil. The effects of these infections are always detrimental to children.

Factors inclusive of poverty, poor sanitation, inadequate hygiene, illiteracy, ecosystem variations, and overcrowding are directly associated with the infestations arising from the burden of STHs [7]. Additionally, factors such as occupation, household clustering, and climate contribute to the infection prevalence. STH, traditionally endemic in rural areas, is increasingly becoming a public health problem in urban slums of cities in tropical and sub-tropical developing countries of the world [8]. Epidemiological surveys have validated that poor sanitary conditions, such as faecal contamination of water bodies, are the most important factors that promote intestinal worm infestation [9], whilst the spread of these diseases is due to poor personal hygiene [10]. Soil-transmitted helminth infection can be prevented through good sanitation, anti-helminthic drug treatment, health education, and periodic deworming [7, 11].

Etche region in Rivers State, Nigeria, is no exception in contributing to the global burden of soil-transmitted helminth infections. Several studies have been conducted in different parts of Rivers State to educate on, principally, the epidemiological profile of intestinal helminths. However, little is known of the prevalence of soil-transmitted helminths or other factors that might increase susceptibility in school-age pupils in Etche Local Government Area of Rivers State. Hence, this study aimed to assess the prevalence of infection among this age group to contribute baseline information that will help in designing a comprehensive control programme in the area.

2. Material and methods

2.1. Study Area

The study was conducted among pupils in State School 1 Ozuzu, State School 2 Egbu and Community Primary School Orwu, all in Etche Local Government Area, Rivers State.

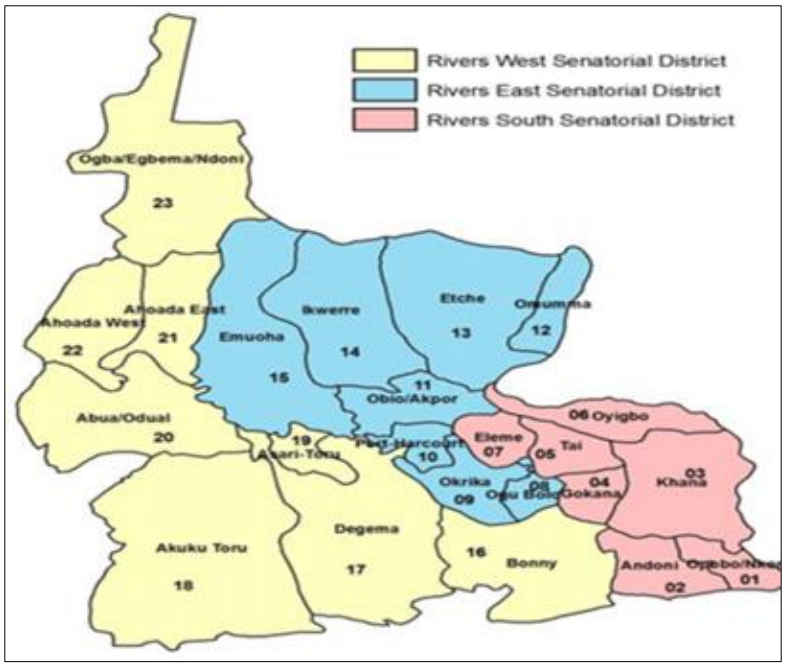

Figure 1 Map of Rivers State

2.2. Sample Size Determination

A systematic random sampling technique was used in the selection of subjects for the determination of soil-transmitted helminth infections. To determine the minimum sample size of the subjects to be recruited in the study, the incidence of intestinal parasites and associated risk factors among Primary School pupils in Etche Local Government Area, Rivers State, Nigeria by Anwuri and Elele [12] which revealed a prevalence of 11% was used to calculate the minimum sample size using the Cochran's Sample size formula as shown below;

Using the formula;

$$N = \frac{Z^2 pq}{d^2}$$

Where:

N	=	Desired sample size
Z	=	Standard normal deviation corresponding to 95% confidence level set at 1.96
p	=	The prevalence of population = 11% = 0.11
q	=	1 – 0.11 = 0.88
d	=	sample error; 5% = 0.05

So,

$$N = \frac{(1.96)^2 \times 0.11 \times 0.88}{(0.05)^2}$$

$$N = \frac{3.84 \times 0.0979}{0.0025}$$

$$N = 150 \text{ Samples}$$

2.3. Study Design

This study was a cross-sectional study among 150 pupils (5-14 years old) of both genders (male and female) attending the three selected community (public) primary schools in Etche LGA whose written and signed parental/guardian consent was obtained for participation in the study. Fifty (50) pupils were randomly selected from each school based on the inclusion criteria.

2.4. Eligibility Criteria

2.4.1. Inclusion Criteria

All children from 5-14 years attending the three selected community primary school in Etche whose parents/guardians gave their consent to participate were included in this study.

2.4.2. Exclusion criteria

Children who had previously been dewormed close to the study period and whose parents/guardians refused to give their consent were immediately excluded.

2.5. Ethical Considerations

Informed consent was sought from the school administrators, parents/guardians of the pupils, and the pupils themselves. Consent forms with clear explanations of the purpose of the study, its potential risks and benefits, and the voluntary nature of participation were filled. Privacy and confidentiality were maintained throughout the study by ensuring that the data collected were anonymized and protected.

2.6. Data Collection

The study used a combination of methods for data collection, including questionnaires and laboratory analysis of stool samples. A structured questionnaire was administered to pupils and their parents/guardians to collect demographic information, including age, gender, and deworming history. The questionnaire included questions about hygiene practices and awareness of soil-transmitted helminths. Stool samples were collected from consenting participants for laboratory analysis.

2.7. Stool Sample Collection

Stool sample collection was carried out on multiple consecutive days to increase the chances of detecting any parasitic infections. Participants were provided with clean, labelled containers for stool collection, along with clear instructions on proper collection techniques. The collected samples were kept in a cool and dry place to preserve their integrity until analysis.

2.8. Parasitological examination

The Kato-Katz technique was employed to examine the stool samples according to Vadlejch *et al*. [13]. This technique involves preparing thick smears of the samples on microscope slides, which were then examined under a microscope. Counting and identification of soil-transmitted helminth eggs were carried out, allowing for the quantification of parasite eggs per gram (EPG) of faeces.

2.9. Statistical Analyses

Data obtained was analyzed using description statistics where variables were summarized using frequencies and percentages. The chi-square test was used to test for the association between helminth infection rates and socio-demographic factors using GraphPad prism. The statistical significance threshold was set at $P < 0.05$.

3. Results

3.1. Prevalence of soil-transmitted helminth infection among school-aged children in the three selected schools

This study recorded a 46% overall prevalence of soil-transmitted helminth infection among the pupils examined. The prevalence of soil-transmitted helminth infection was 34% in State School 1 Ozuzu, 56% in State School 2, and 48% in Community Primary School Orwu. Pupils in State School 2 Egbu had the highest infection rate (56%) (Table 1).

Table 1 Prevalence of soil-transmitted helminth infection among school-aged children in the three selected schools

School	Total no. examined	Total no. uninfected (%)	Total no. infected (%)
State School 2 Egbu	50	22 (44)	28 (56)
Community Primary School Orwu	50	26 (52)	24 (48)
State School 1 Ozuzu	50	33 (66)	17 (34)
Total	150	81 (54)	69 (46)

3.2. Prevalence of soil-transmitted helminth infection in the three schools in Etche among different age groups

Table 2 shows the prevalence of soil-transmitted helminth infection in the three schools in Etche among different age groups. This study showed that pupils between the ages of 8-11 years had the highest prevalence of infection (60%) in the State school 2 Egbu and those between ages 5-7 years were the most infected (65%) in Community primary school Orwu; while pupils within ages 12-14 years were the most infected (53.3%) in State School 1 Ozuzu. Overall, pupils between the ages of 5-7 years were the most infected (43.5%) across the three schools. There was no association ($P > 0.05$) between age and the prevalence of soil-transmitted helminth infection in the three schools in Etche (Table 2).

Table 2 Age-related prevalence of soil-transmitted helminth infection in three selected schools

Age group	State School 2			Community Primary School			State School 1			Total no. examined	Total no. infected
	No. examined	No. infected with STHs	(%)	No. examined	No. infected with STHs	(%)	No. examined	No. infected with STHs	(%)		
5-7	20	11	55	20	13	65	20	6	30	60	30(43.5)
8-11	15	9	60	15	5	33.3	15	3	20	45	17(24.6)
12-14	15	8	53	15	6	40	15	8	53.3	45	22(31.9)
Total	50	28	56	50	24	48	50	17	34	150	69
P-value		0.9282			0.1358			0.1386			1.7624
χ^2		0.1488		3.9931			3.9513			0.4143	

3.3. Prevalence of soil-transmitted helminth infection in three selected schools according to gender

Results obtained from this study on the prevalence of soil-transmitted helminth infection in three selected schools according to gender showed that males (52%) were more infected than females (40%). In State School 1, females were more infected than the males, while males were more infected than the females in both State School 2 and Community Primary School. There was no association (P>0.05) between gender and the prevalence of soil-transmitted helminth infection in the three schools in Etche (Table 3).

Table 3 Prevalence of soil-transmitted helminth infection in three selected schools according to gender

Gender	State school 2			Community Primary School			State School 1			Total no. examined	Total number infected (%)
	No. examined	No. infected with STHs	(%)	No. examined	No. infected with STHs	(%)	No. examined	No. infected with STHs	(%)		
Male	25	17	68	25	15	60	25	7	28	75	39 (52)
Female	25	11	44	25	9	36	25	10	40	75	30 (40)
Total	50	28		50	24		50	17		150	69 (46)
P-value		0.0874			0.0894			0.7310			0.1404
χ^2		2.922			2.885			0.1182			2.174

3.4. Parasite species recorded in children in the three selected schools.

The study recorded the occurrence of 4 species of soil-transmitted helminths in the pupils examined in the three selected schools, which included *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworms and *Strongyloides stercoralis*. *A. lumbricoides* occurred most in this study in all the schools, followed by Hookworm. *S. stercoralis* in the respective schools was the least prevalent parasite species in all the schools (Table 4).

Table 4 Parasite species recorded in children in the three selected schools.

School	Total no. examined	*Ascaris lumbricoides* (%)	*Trichuris trichiura* (%)	Hookworms (%)	*Strongyloides stercoralis* (%)
State School 2	50	12 (24)	6 (12)	8 (16)	2 (4)
Community Primary School	50	15 (30)	2 (4)	7 (14)	0 (0)
State School 1	50	9 (18)	3 (6)	4 (8)	1 (2)
Total	150	36	11	19	3

4. Discussion

The overall prevalence of soil-transmitted helminths (STH) infection in the three selected schools in this study was 46%, which is comparable with the prevalence report of 46.3% in a study conducted by Ojurongbe *et al*. [14] in Osun State, Nigeria. On the other hand, the report from this study is lower than the 59.4% prevalence reported by Gboeloh and Ndamzi [15] at Nkpor and Mgbodohia communities in Rivers State. This suggests that location differences may pose varying impacts on the epidemiology of soil-transmitted helminths in the State. Meanwhile, a study conducted by Anunobi *et al*. [16] in Kogi recorded a relatively lower prevalence of 34.2%, suggesting that Rivers State may be at higher risk of STH due to the favouring environmental condition. The State's humid and warm climate presents a suitable environment for the survival and transmission of STH eggs in the soil. The prevalence of STH reported in this study is way higher than the global report [17], emphasizing the endemicity of STH in the state.

The findings from this study revealed that pupils between the ages of 5-7 years were the most infected across the three schools. However, there was no significant association between age and the prevalence of soil-transmitted helminth

infection in the three schools. This report disagrees with the study by Semwogerere *et al*. [18] who stated that there was an age-based relationship with STH prevalence, with those between 18-29 years being more vulnerable to STH infection. Children between the ages of 5-7 years are more vulnerable to infestation due to their poor hygiene practices and play habits which bring them in close contact with contaminated soil [6].

Males (52%) being more infected than females (40%) in this study could be a result of them getting involved with playground activities such as stunts and football on bare feet. This result is in agreement with the findings of Mogaji *et al.* [19].

This study recorded the occurrence of *A. lumbricoides*, *T. trichiura*, Hookworms, and *S. stercoralis* with the most prevalent STH being *A. lumbricoides*. Similarly, Semwogerere *et al*. [18]; Damen *et al*. [20], and Yaro *et al*. [21] reported the prevalent nature of *A. lumbricoides* worm in their studies. The development and transmission of these soil-transmitted helminths indicate that soil, food, and water might be contaminated with infective stages. Though the school environments had better water conditions, however, the prevalent sanitary condition of the study area favours the development and transmission of the parasites. Poor hygiene practices of not washing hands with soap after defecation and attitudes such as picking food from the ground, playing on contaminated soil, and more importantly, not wearing sandals might have predisposed these pupils to the risk of contaminating their hands with infective ova of *A. lumbricoides* and also active penetration of infective hookworm larvae on soil as the case may be. Lack of clean water, poor standards of public and personal hygiene, and inadequate health education promote the spread of such parasites [9, 10]. Some of the parasites have a high fecundity rate which may last long. In many places where sanitation and safe refuse disposal are non-existence, the environment becomes thoroughly contaminated and infection is difficult to avoid.

5. Conclusion

This study recorded an overall prevalence of 46% for soil-transmitted helminths among school-aged pupils in three selected community primary schools in Etche Local Government Area, Rivers State, which is way higher than the WHO global report**,** emphasizing the endemicity of STH in the State. *A. lumbricoides* was the most prevalent soil-transmitted helminth in the area, but age and sex were not significant in the distribution of the parasites in the study area. A comprehensive control programme should be implemented in the study area to curb the spread of infection.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflicts of interest.

Statement of ethical approval

Ethical approval was obtained from the Ethics Committee of the Department of Medical Laboratory Science, Faculty of Science, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria.

Statement of informed consent

Informed consent was obtained from the school administrators, parents/guardians of the pupils, and all individual participants included in the study.

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