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EVALUATION OF SOIL TRANSMITTED HELMINTHS INFECTIONS AND THEIR RISK FACTORS AMONG PRIMARY SCHOOL PUPILS IN SELECTED COMMUNITIES IN OSUN-STATE, SOUTHWEST, NIGERIA

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ABSTRACT

Soil-transmitted helminthiasis (STH) remains a major public health problem in rura Nigeria, with school-aged children being the most vulnerable group. Despite this information on the prevalence, intensity, and associated risk factors of STH infection among primary school pupils in Osun State is limited. This study investigated the prevalence, intensity, and determinants of STH infections among primary schoo children in selected rural communities of Osun State, Nigeria, and assessed thei knowledge of preventive and control measures. A cross-sectional survey wa conducted among 200 pupils drawn from three communities. Stool samples were collected and examined microscopically using a filtration technique, while infectio intensity was determined using the Kato–Katz method for positive samples. A structured questionnaire was administered, with appropriate consents, to evaluate pupils' knowledge, attitudes, and practices related to STH control. Overall, an STH prevalence of 18.0% was recorded. Infection was more common among males (10.5% and children aged 10 years and above (10.0%). Egg counts ranged from 1 to 68,52(eggs per 5 g of faeces, with a mean intensity of 342.6 eggs, and a significantly highe proportion of pupils exhibiting heavy infections (15.5%, $P < 0.05$). Housing condition and hygiene practices were identified as important risk factors; pupils living i unprotected housing and those who rarely washed their hands after contact wit potentially contaminated environments showed higher infection rates. Althoug awareness of STH existed among pupils, knowledge regarding transmission an prevention was generally inadequate. The findings indicate persistent transmission i these communities and highlight the need for integrated control strategies, includin improved housing and sanitation, enhanced health education, promotion of persona hygiene, access to safe drinking water, and sustained school-based deworming programmes.

1. INTRODUCTION

Soil Transmitted Helminths (STHs) are one of the most common infections in humans especially in tropical and sub-tropical countries (Damen, *et al*., 2011). There are four species of intestinal helminthic parasites, also known as geohelminths that are soil-transmitted, these include: *Ascaris lumbricoides (roundworm), Trichiuris trichiuria (whipworm), Ancylostoma duodenale, and Necator americanicus(hookworms).* These infections are most prevalent in tropical and subtropical regions of the developing world where adequate water and and sanitation facilities are lacking (WHO, 2020). People of all ages are susceptible to infection, with the huge morbidity found in children due to low levels of acquired immunity and high exposure to contaminated soil (Sadya *et al*., 2019). Intestinal helminths rarely cause death. Instead, the burden of disease is related to less mortality than to the chronic and insidious effects on health and nutritional status of the host. The effects are coupled with impair physical and mental growth of children,

thwart educational achievement, and hinder economi development (Adeniran *et al*., 2017). STHs can ge into the intestine through the mouth from uncooked o unwashed food, contaminated water or hands or b skin contact with larva-infested soil. People can als become infected with intestinal parasites if they hav mouth contact with the genital or rectal area of sexual partner who is infected (e.g. oral sex or anal oral contact). When the eggs of the organisms ar swallowed, they are hatched and move into th intestine where they penetrate the intestinal mucosa t gain access to the organ of interest, where the reproduce and cause disease. In some people, intestina parasites do not cause any symptoms or the symptom may come and go. Common signs and complaint include coughing, cramping, abdominal pain, bloatin and diarrhea (WHO, 1996).

The global burden of STHs infection in pupils has bee linked to decreased academic performance an anaemia. However, more than 500,000 DALYs/yea have been estimated to have been averted by contro (World Health Organization, 2016b). Nigeria i documented to have high numbers of people infecte with STHs in sub-Saharan Africa (Oluwole *et al*. 2017) with school-age children (SAC) implicated wit most infections (Kirwan *et al*., 2009). This, however was noted to have declined with the introduction of th 'Mass Administration of Medicines' (MAM) fron 2016 to 2018. Studies have shown that Osun State i south-western Nigeria is endemic for intestina helminthiasis but no recent studies have bee conducted to validate the present situation. Untreate adults remain important reservoirs for re-infection of treated children in endemic areas (Ásbjörnsdóttir *et al*., 2017) and poor fecal disposal is still a problem in Nigeria (Taiwo *et al*., 2017).

Several studies have attributed malnutrition as a facto that increases the impact of the infections. Schoo children go to school hungry and more than 10 millio children do not attend school at all because of poverty The Nigerian Home-Grown School Feeding Strategi Plan (2016–2020) Abuja which Osun State commence HGSFP in December 2010 was later terminated Studies on the impact of School Feeding Progra (SFP) on intestinal helminthes have shown reduction i prevalence of intestinal parasites among pupils wh participated in the SFP (Taiwo *et al*., 2017). The SF was stopped in schools in 2018; scientific evaluatio has not been conducted to determine the role of SFP o intestinal parasites among the pupils of the school tha were previously engaged in SFP. There is currently n known empirical data to compare the impacts. Suc studies are needed to inform policies as it affects th health and development of pupils. Thus, this stud assessed the status of intestinal helminthiasis among som selected primary school pupils in selected communitie in Osogbo, Osun State. This could be compared wit the pre HGSFP existing data on the prevalence o intestinal parasitic infections among primary scho pupils to determine the impact of SFP on pupils. Th present study seeks to determine the prevalence distribution and risk factors for STH infections amon primary school pupils in selected areas in Osun State t contribute to national data on prevalence, burdens an risk zones (RZs) for STH infections which is currentl lacking.

2. MATERIALS AND METHODS

Study Area:

This is a school-based cross-sectional study that wa carried out in three public primary schools in Osu State, Southwestern Nigeria. The schools are Anthon Udofia Primary School, Osogbo (7.78314°N 4.53614°E), AUD Primary School, Gbonmi, Osogb (7.77808°N, 4.56627°E), and St. Gabriel Primar School, Ore (Latitude 7°44' and 7°57'N and Longitud 4°26'and 4°41'E). The study was undertaken betwee June 2023 to July 2023. Fecal samples were collecte from different age groups and different gender. Dat was collected by designing and distributin questionnaire to the pupils. Study subjects wer selected using a systematic random sampling method.

Ethical Consideration:

Ethical clearance (OSHREC/PRS/569T/337) wa obtained from Osun State Ministry of Health, Osogbo Osun State. Permissions to screen the students wer sought from the parents and the schools' principals Informed consents were given by individua participants after explaining the objectives, possibl outcome and benefits of the research. Before sampl collection, meetings were held with parents, schoo principal, and teachers. The aim of the study, the stud procedures, types of specimens required, and benefit of the study to individuals and to the pupils and risk involved were included in the informed consent letter and fully explained to parents and children. Parent and legal guardians were asked to give their verba consent for the children who were willing to b sampled after being given proper information about th study.

Study Population Samples:

A total of two hundred (200) fecal samples were take from individuals of different age groups and sexes fro the three primary schools. Added information sough included water source, toilet or latrine use, Type o residential house and demographic data such as sex age, other activities done outside school and hygien level of subject were recorded.

Eligibility criteria.

All of the pupils who were willing to be part of th study, and had not taken anti-helminth drugs within th last six months before the study, were recruited into th study. Pupils whose parents gave consent to participat in the study and those without a severe medica condition were recruited into the study. The exclusio criteria included pupils whose parent or guardian di not give consent.

Sample collection and Laboratory Analysis

The microscope was carried to each school and th collected stools were examined on the spot. Th collected stools were examined without dela microscopically for the presence of eggs of intestina parasites using direct saline method. Kato Katz techniques were used on the positive ones to determin the intensity of infection as previously described b Rufai *et al*. (2017). The intensity of infection wa expressed as the number of eggs per gram (epg) o feces, the standard measurement to assess the intensit of infection. Finally, the number of eggs were counte and multiplied by 24 (appropriate number on the Kat Katz kit) to give the number of eggs per gram (epg) –

the standard measurement as previously described by WHO (1992). To ensure consistency of the result and as a form of quality control, 20% of the slides were randomly selected and read again. The epg was classified according to the WHO classification as light infection (epg< 100), moderate infection (epg 100–399), and heavy infection (epg ≥ 400).

Statistical Analysis

The prevalence of infection among the examined pupils was calculated using the number of infected pupils divided by the total number of pupils examined. The data obtained from this study were subjected to odd ratio analysis using InStat statistical package. The difference was considered statistically significant when $P<0.05$

3. RESULTS

Table 1: Overall prevalence of intestinal helminths infection in the three (3) primary schools sampled in the three LGA of Osun State

School	Number Examined/School	Total No infected / School	Prevalence (%)
Anthony Udofia Primary School Osogbo	100	5	2.5
AUD Primary School, Gbonmi Osogbo	50	10	5.0
St Gabriel Primary School, Ore	50	21	10.5
Total	200	36	18.0

Table 2: Sampled primary school-specific parasites prevalence

School	Type of Parasite seen	No infected (n=200)	Prevalence (%)
St Gabriel primary school	*Ascaris lumbricoides*	21	10.5
	Schistosome mansoni	2	1.0
AUD primary school	*Ascaris lumbricoides*	10	20.0
Anthony Udofia primary school	*Ascaris lumbricoides*	5	5.0

Table 3: Intensity-specific prevalence of intestinal helminths among the primary school pupils.

School	Type of Parasite seen	No of eggs counted (by 24 EPG Kato-katz standard)
St. Gabriel primary school	*Ascaris lumbricoides*	68520
	Schistosome mansoni	48
AUD primary school	*Ascaris lumbricoides*	14880
Anthony Udofia primary school	*Ascaris lumbricoides*	4416

Table 4: Prevalence of intestinal helminths in relation to town

Town	No. Examined	No infected	Prevalence (%)
Ore	50	31	15..5
Osogbo	150	5	2.5
Total	200	36.0	18.0

Table 5: Sex-specific prevalence of intestinal helminths among selected primary school pupils.

Parasite/Sex	No. Examined	No infected	Prevalence (%)
Ascaris lumbricoides			
Male	85	21	10.5
Female	115	15	7.5
Total	200	36	18.0
Schistosoma mansoni			
Male	85	2	1.0
Female	115	0	0
Total	200	2	1.0

Table 6: Age-Specific Prevalence of Intestinal Parasites among selected primary school pupils

Age group (Years)	No. Examined	No. infected	Prevalence (%)
Below 10 years	122	16	8.0
10 years and above	78	20	10.0
Total	200	36.0	18.0

Table 7: Single and Double Intestinal Parasites Infection among Randomly Selected Primary School Students in Osogbo Metropolis.

Infection	No. infected	Prevalence(%)
Single Infection		
Ascaris lumbricoides	36	18.0
Schistosoma mansoni	2	1.0
Total	38	19.0
Double Infection		
Ascaris lumbricoides/ Schistosoma mansoni	2	1.0
Total	2	5.6

Table 8: Prevalence and intensity of Intestinal Parasites infections in relation to parent's occupation

Parent Occupation	No. Examined	No. infected	Prevalence (%)
Civil servant	65	5	2.5
Company worker	25	5	2.5
Trader	72	10	5.0
Farmers	20	13	6.5
Unemployed	15	2	1.0
Not in Labour Force	3	1	0.5
Total	200	36	18.0

Table 9: Prevalence and intensity of Intestinal Parasites infections in relation to Body Mass Index of the pupils

BMI of pupil	No. Examined	No. infected	Prevalence (%)
< 18.5 (Underweight)	115	25	12.5
18.5 – 24.5 (Healthy)	35	6	3.0
24.5 – 30.((Overweight)	28	3	1.5
30.0+ (Obese)	22	2	1.0
Total	200	36	18.0

Table 10: Response to questionnaire and relationships between various epidemiological variables and the Soil Transmitted Intestinal Parasitic Infections among the selected pupils.

Risk Factors	No. Examined	No. infected	Prevalence (%)	X^2	P-value
Type of Residential House				3.049	0.374
block house with protected doors and windows	189	28	5.0		
block house without protection from housefly	11	8	13.0		
Total	200	36	18.0		
Knowledge of STHs				8.531	0.041
Have knowledge of STHs	186	33	16.5		
Have no knowledge STHs	14	3	1.5		
Total	200	36	18.0		
Toilet Facility				3.484	0.034
Water cistern	136	25	12.5		
Pit latrine	57	10	5.0		
Open field defecation	7	1	0.5		
Total	200	36	18.0		
How often do you wash your hanc				8.443	0.07

after toilet?					
All the time	23	4	2.0		
Sometimes	30	5	2.5		
Rarely	147	26	13.0		
Total	200	36	18.0		
Water Source				5.281	0.002
Pipe borne water	62	11	5.5		
Borehole	110	20	10.0		
Well	28	5	2.5		
Total	200	36	18.0		
Are there water sources close t the school?				0.020	0.641
Yes	191	34	17.0		
No	9	2	1.0		
Total	200	36	18.0		
Are there health facilities close t the schools				0.010	0.820
Yes	195	35	17.5		
No	5	1	0.5		
Total	200	36	18.0		
What other activities do you d out of school?				8.531	0.041
Football	105	19	9.5		
Gardening	29	5	2.5		
Playing with sibling and friends	66	12	6.0		
Total	200	36	18.0		

4. DISCUSSION

Soil-transmitted helminth (STH) infections primarily affect the intestinal tract and remain widely distributed across tropical and subtropical regions, particularly in low- and middle-income countries where access to clean water, sanitation, and hygiene facilities is inadequate (WHO, 2020). While light infections are often asymptomatic, heavy worm burdens are associated with significant morbidity, including gastrointestinal disturbances, nutritional deficiencies, impaired physical growth, and reduced cognitive development. Co-infections and repeated exposure further exacerbate anemia, poor appetite, school absenteeism, and diminished academic performance, especially among children (Raj *et al*., 1997).

Findings from the present study revealed that 18.0% of the examined pupils were infected, with *Ascaris lumbricoides* being the predominant parasite and only a few cases of *Schistosoma mansoni* detected (Table: 1). This pattern aligns with earlier epidemiological reports from southwestern Nigeria (Adeniran *et al*., 2017). Marked variation in prevalence was observed between schools, largely reflecting differences in environmental and socio-economic conditions. (Table 10). Pupils attending schools in rural settings recorded higher infection rates than those in urban locations (Table: 4). For instance, the school located in Ore showed a substantially higher prevalence than those situated within Osogbo metropolis. Poor

Poor sanitation, limited access to hygiene facilities, parental occupation, and increased environmental exposure likely contributed to this disparity.

Although the prevalence recorded in this study exceeds earlier reports from similar settings (Rufai *et al*., 2017), it underscores the persistent transmission of STHs in rural communities. The higher infection rate recorded in St. Gabriel Primary School suggests a heavier local disease burden, whereas lower prevalence in urban schools may reflect better hygiene awareness and infrastructure.

Infection intensity also followed a similar rural–urban gradient, with pupils in rural schools exhibiting markedly higher egg counts (Table 3). This observation suggests increased exposure and reinfection due to environmental contamination. *Ascaris lumbricoides* accounted for the highest infection intensity, consistent with its ability to survive under harsh environmental conditions and its highly adhesive eggs.

Despite a proportion of infected pupils demonstrating some awareness of intestinal helminths, this knowledge did not translate into reduced prevalence or intensity. This gap may be attributed to inadequate health education and the absence of essential hygiene facilities such as handwashing stations, soap, and sanitizers in most schools.

Age- and sex-related differences were also evident (Table 5). Higher infection rates were observed among younger pupils and males, possibly due to greater engagement in soil-related activities and poorer hygiene practices. Similar sex-related trends have been reported by Mationg *et al*. (2017), although contrasting findings exist in the literature (Adache & Chessed, 2023), highlighting the influence of local behavioral patterns.

Parental occupation emerged as an important risk factor (Table 8), with children of farmers showing higher infection rates, particularly in rural areas. Farming activities often involve close contact with contaminated soil, increasing the likelihood of household transmission (Ukpai and Ugwu, 2003). Additionally, underweight pupils were more frequently infected (Table 9), suggesting a link between poor nutritional status, low socio-economic background, and susceptibility to STHs.

Environmental and housing conditions further influenced infection patterns. Open defecation and poorly protected housing were associated with higher prevalence (Table 10), possibly due to increased mechanical transmission of infective stages by vectors such as houseflies. These findings reinforce earlier reports linking inadequate housing and sanitation to sustained helminth transmission (Crompton, 1999)

The predominance of *A. lumbricoides* observed in this study (Table 7) is consistent with national trends (Rufai *et al*., 2018). Its adhesive eggs facilitate transmission through contaminated surfaces, food items, and poor hand hygiene. The limited occurrence of *S. mansoni* was likely associated with proximity to

freshwater bodies, as previously documented (Noriode *et al*., 2018).

Mixed infections involving *A. lumbricoides* and *S. mansoni* were recorded, reflecting overlapping ecological and transmission requirements. Although other studies have reported more complex parasite combinations (Udonsi *et al*., 1996), the observed co-infection highlights the need for integrated control strategies.

5. CONCLUSION

Overall, the findings emphasize that STH infections remain a public health concern, particularly in rural school settings, and call for sustained interventions. The high prevalence reported in these communities require integrated approach to control which essentially should incorporate the provision of protected residential houses and sanitary facilities as well as adequate health education on knowledge of Soil Transmitted Helminths in addition to advocacy on good personal hygiene coupled with good drinking water and deworming programs to reduce transmission.

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