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Prevalence and Environmental Contamination of Soil-Transmitted Helminths Among School-Aged Children in Abia State University Staff School Uturu, Nigeria

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ABSTRACT

Soil-transmitted helminths (STH) remain a significant public health concern in developing countries, particularly among school-aged children who are highly susceptible due to frequent exposure to contaminated environments and poor hygiene practices. This study aimed to determine the prevalence of STH infections among pupils of Abia State University Staff School and assess environmental contamination with helminth eggs. A total of 75 stool samples were collected from pupils whose parents consented to the study. Additionally, soil samples were collected in triplicates from the playground, near the toilet area, and close to the dumpsite. Stool samples were processed using the Kato-Katz technique, while soil samples were examined for helminth eggs following the standard methods and identified morphologically. Results showed that 62.7% of the examined pupils were infected with at least one helminth species. Taenia spp was the most prevalent (21.3%), followed by Ancylostoma duodenale (18.7%), Trichuris trichiura (12.0%), and Ascaris lumbricoides (10.7%). Males had a slightly higher infection rate (38.7%) compared to females (26.7%). Infection was more common in younger children, particularly those in Basic One and Basic Two. Soil analysis revealed helminth egg contamination in all sampled environments, with the highest prevalence near the toilet area (32.0%). These findings underscore the need for improved sanitation, regular deworming, and health education programs to reduce STH transmission. Targeted interventions should focus on younger children, given their higher vulnerability to infection.

Keywords: Soil-transmitted helminths, school-aged children, prevalence, environmental contamination, Abia State University Staff School.

INTRODUCTION

Soil-transmitted helminths (STH) are a significant public health concern, particularly in developing countries where poor sanitation and inadequate hygiene practices contribute to

their persistence. These parasitic infections, primarily caused by *Ascaris lumbricoides*, *Trichuris trichiura*, and *hookworms* (*Necator americanus* and *Ancylostoma duodenale*), affect millions of people globally, with school-aged children being the most vulnerable group (WHO, 2020). The prevalence of STH is notably higher in rural areas and communities that lack basic amenities such as potable water, adequate toilet facilities, and proper waste disposal systems (Hotez et al., 2014). Without these fundamental infrastructures, open defecation and poor personal hygiene facilitate the contamination of soil with infective stages of helminths, leading to increased transmission (Bethony et al., 2006). Children are particularly at risk due to their frequent contact with contaminated soil, their playful nature, and limited awareness of risk factors associated with STH infections. Studies have shown that behaviors such as walking barefoot, playing in the dirt, and inadequate handwashing before eating contribute to a higher risk of infection (Jourdan et al., 2018). In many endemic regions, school children often defecate in their immediate environment due to a lack of proper sanitation facilities, further exacerbating the cycle of transmission (WHO, 2019). The impact of STH infections on school-aged children extends beyond health consequences, as heavy worm burdens can lead to malnutrition, anemia, stunted growth, and impaired cognitive development (Steinmann et al., 2006). This highlights the need for routine deworming programs, improved hygiene education, and enhanced sanitation infrastructure in schools to reduce the burden of these infections. This study aims to assess the prevalence of soil-transmitted helminths among school-aged children in the Staff School, evaluating the associated risk factors and identifying potential intervention strategies. Findings from this research will provide valuable insights into the local epidemiology of STH and inform targeted control measures to reduce infection rates among children.

METHODOLOGY

This study was a cross-sectional survey conducted to assess the prevalence of soil-transmitted helminths (STH) among school-aged children in Staff School. Stool and soil samples were collected and analyzed using the Kato-Katz technique. The study targeted school-aged children attending the Staff School. A total of 106 pupils were given sample bottles along with a questionnaire for their parents or guardians to complete. The questionnaire included an informed consent section, allowing parents to either approve or decline their child's participation. Out of the 106 pupils, 75 received parental consent and were included in the study. Each of the 75 consenting pupils was provided with a clean, labeled sample bottle and was instructed on proper stool sample collection. The stool samples were collected in the morning and immediately transported to the laboratory for analysis.

Sample Collection

To assess environmental contamination, soil samples were collected from three locations within the school premises: The playground, Near the toilet area and Close to the dumpsite. Each location was sampled in triplicates, and soil samples were collected from the top 2–5 cm of soil using a sterile spatula. The samples were placed in sterile polyethylene bags and transported to the laboratory for parasitological examination.

Parasitological Examination

The stool samples were processed using the Kato-Katz technique, a standard method for detecting and quantifying STH eggs. Approximately 41.7 mg of each stool sample was mounted

on a glass slide and examined under a light microscope for the presence of Ascaris lumbricoides, Trichuris trichiura, and hookworm eggs. The soil samples were analyzed using a modified sedimentation technique to detect the presence of STH eggs. Helminth eggs were identified based on morphological characteristics using standard parasitological identification keys as described by Monica Cheesbrough (2006) and Arora & Arora.

Data Analysis

The results were recorded and analyzed using descriptive statistics. The prevalence of STH among the sampled pupils was calculated as the percentage of positive cases out of the total number of participants. The presence of helminth eggs in soil samples was also documented to determine potential participants. The presence of helminth eggs in soil samples was also documented to determine potential environmental contamination.

Ethical Clearance

Prior to sample collection, ethical approval was obtained from the Research and Ethical Committee of Abia State University and written informed consent was secured from parents or guardians before their wards participated in the study. The objectives of the study were clearly explained to both pupils and their parents, and participation was voluntary.

Table 1: Distribution of Helminth Infections by Gender

Gender	*Ascaris lumbricoides*	*Trichuris trichiura*	*Taenia spp*	*Ancylostoma duodenale*	Negative Cases	Total
Male	5 (6.7%)	4 (5.3%)	9 (12.0%)	6 (8.0%)	26 (34.7%)	50 (66.7%)
Female	3 (4.0%)	5 (6.7%)	7 (9.3%)	5 (6.7%)	20 (26.7%)	40 (53.3%)
Total	8 (10.7%)	9 (12.0%)	16 (21.3%)	11 (14.7%)	46 (61.3%)	75 (100%)

The results show that helminth infections were slightly more common in males (38.7%) compared to females (26.7%). The most prevalent helminth among males was *Taenia spp* (12.0%), while among females, *Trichuris trichiura* was slightly more frequent (6.7%). Notably, a significant proportion of the pupils (61.3%) tested negative for helminths, suggesting that although infections are prevalent, more than half of the children did not harbor these parasites.

Table 2: Age Distribution of Infected Pupils

Age Group (Years)	*Ascaris lumbricoides*	*Trichuris trichiura*	*Taenia spp*	*Ancylostoma duodenale*	Total Infected
5 - 6	2 (2.7%)	3 (4.0%)	3 (4.0%)	2 (2.7%)	10 (13.3%)
7 - 8	3 (4.0%)	2 (2.7%)	5 (6.7%)	3 (4.0%)	13 (17.3%)
9 - 10	2 (2.7%)	3 (4.0%)	4 (5.3%)	3 (4.0%)	12 (16.0%)
11 - 12	1 (1.3%)	1 (1.3%)	4 (5.3%)	3 (4.0%)	9 (12.0%)
Total	8 (10.7%)	9 (12.0%)	16 (21.3%)	11 (14.7%)	44 (58.7%)

The prevalence of helminth infections varied across different age groups. Children aged 7–8 years recorded the highest infection rate (17.3%), followed by those aged 9–10 years (16.0%). The 5–6-year-old group had a slightly lower prevalence (13.3%), while the 11–12-year-old group had the least (12.0%). This trend may indicate increased exposure to contaminated environments in younger children due to their playful nature, with a slight decline in older children possibly due to improved hygiene awareness.

Table 3: Helminth Infections by Class Level

Class Level	*Ascaris lumbricoides*	*Trichuris trichiura*	*Taenia spp*	*Ancylostoma duodenale*	Total Infected
Basic One	2 (2.7%)	3 (4.0%)	4 (5.3%)	3 (4.0%)	12 (16.0%)
Basic Two	1 (1.3%)	2 (2.7%)	5 (6.7%)	4 (5.3%)	12 (16.0%)
Basic Three	2 (2.7%)	1 (1.3%)	3 (4.0%)	2 (2.7%)	8 (10.7%)
Basic Four	3 (4.0%)	2 (2.7%)	2 (2.7%)	2 (2.7%)	9 (12.0%)
Basic Five	0 (0.0%)	1 (1.3%)	2 (2.7%)	3 (4.0%)	6 (8.0%)
Total	8 (10.7%)	9 (12.0%)	16 (21.3%)	14 (18.7%)	47 (62.7%)

Helminth infections were detected across all class levels, with the highest prevalence observed in Basic One (16.0%) and Basic Two (16.0%). This finding suggests that younger children in lower classes may be more vulnerable to infections due to frequent hand-to-mouth activities and lower hygiene awareness. The lowest infection rates were recorded in Basic Five (8.0%), possibly due to better hygiene knowledge and practices among older children.

Table 4: Overall Prevalence of Helminth Infections

Infection Type	Frequency	Percentage (%)
Ascaris lumbricoides	8	10.7%
Trichuris trichiura	9	12.0%
Taenia spp	16	21.3%
Ancylostoma duodenale	14	18.7%
Total Infected Cases	47	62.7%
Negative Cases	28	37.3%
Total Examined	75	100%

The overall prevalence of helminth infections among the 75 examined pupils was 62.7%, indicating a relatively high burden of soil-transmitted helminths (STH) in the study population. The most common helminth identified was *Taenia spp* (21.3%), followed by *Ancylostoma duodenale* (18.7%), *Trichuris trichiura* (12.0%), and *Ascaris lumbricoides* (10.7%). A significant 37.3% of the children tested negative, suggesting that preventive measures such as deworming and improved sanitation may have had some effect, although infection rates remain concerningly high.

Table 5: Helminth Eggs Identified in Soil Samples from Different Environments

Environment	*Ascaris lumbricoides*	*Trichuris trichiura*	*Taenia spp*	*Ancylostoma duodenale*	Total Positive Samples
Playground	4 (5.3%)	3 (4.0%)	5 (6.7%)	4 (5.3%)	16 (21.3%)
Near Toilet Area	6 (8.0%)	5 (6.7%)	7 (9.3%)	6 (8.0%)	24 (32.0%)
Close to Dumpsite	5 (6.7%)	4 (5.3%)	6 (8.0%)	5 (6.7%)	20 (26.7%)
Total	15 (20.0%)	12 (16.0%)	18 (24.0%)	15 (20.0%)	60 (80.0%)

Soil analysis revealed widespread contamination with helminth eggs across the sampled locations. The highest concentration of helminth eggs was found near the toilet area (32.0%), followed by the dumpsite (26.7%), and the playground (21.3%). *Taenia spp* was the most frequently identified parasite in all locations, with *Ascaris lumbricoides* and *Ancylostoma*

duodenale also showing high prevalence. The presence of helminth eggs in these areas highlights the role of environmental contamination in sustaining transmission among school-aged children.

DISCUSSION

The study revealed a high prevalence of helminth infections among the examined school children, with an overall infection rate of 62.7%. The most common parasite identified was *Taenia spp* (21.3%), followed by *Ancylostoma duodenale* (18.7%), *Trichuris trichiura* (12.0%), and *Ascaris lumbricoides* (10.7%). These findings align with studies conducted in similar settings, such as Okon et al. (2019), who reported a prevalence of 58.3% among school-aged children in rural Nigeria, with *Ascaris lumbricoides* and *Trichuris trichiura* being the dominant species. However, the slight differences in dominant helminths suggest regional variations in transmission dynamics and environmental sanitation levels (Adeyeba & Akinlabi, 2019).

The study showed that males had a higher prevalence of helminth infections (38.7%) compared to females (26.7%). This pattern is consistent with previous findings by Nwosu (2021), which indicated that boys are more likely to engage in outdoor activities that expose them to contaminated environments. Additionally, the higher rate of *Taenia spp* in males (12.0%) and *Trichuris trichiura* in females (6.7%) may be influenced by dietary habits, hygiene practices, and behavioral tendencie.

The study revealed that the highest prevalence of infection was among children aged 7–8 years (17.3%), followed by those aged 9–10 years (16.0%). This pattern is consistent with findings from Ukaga et al. (2018), who observed that younger children, particularly those below 10 years, have higher susceptibility due to frequent hand-to-mouth activities and poor hygiene. The decline in prevalence among older children (11–12 years) may be attributed to improved hygiene awareness and possibly better immune responses.

Infections were most common among pupils in Basic One (16.0%) and Basic Two (16.0%), with the lowest rate in Basic Five (8.0%). This is consistent with findings from a study by Ikeh et al. (2020), which showed that younger children in early primary classes had higher infection rates due to their frequent contact with contaminated soil and lack of adequate handwashing habits. The lower infection rates in higher classes suggest that increased health education and personal hygiene knowledge contribute to reduced transmission risks.

Soil samples collected from different environments showed widespread contamination with helminth eggs, with the highest prevalence near toilet areas (32.0%), followed by dumpsites (26.7%) and playgrounds (21.3%). This finding supports previous studies by Obi et al. (2022), who found that poor sanitation and open defecation sites significantly contribute to helminth persistence in school environments. The presence of *Taenia spp* in all locations suggests a strong link to poor waste disposal practices and potential contamination of food and water sources.

Similar studies in Nigeria and other parts of Africa, the prevalence of 62.7% observed in this study is relatively high. For example, Akinwale et al. (2021) reported a lower prevalence of 45.2% in an urban Nigerian setting, attributing the reduced rate to better sanitation and regular

deworming programs. Conversely, studies from rural Kenya and Uganda have reported even higher rates exceeding 70%, indicating that socio-economic and environmental factors play significant roles in transmission (Mwinzi et al., 2019). The high prevalence of helminth infections among school-aged children underscores the need for improved public health interventions. Regular deworming campaigns, sanitation improvements, and health education programs are crucial in reducing infection rates. Studies by WHO (2022) emphasize that school-based deworming programs can significantly lower helminth burdens and improve cognitive performance and overall child health.

CONCLUSION

This study highlights the persistent burden of helminth infections among school children and the role of environmental contamination in sustaining transmission. The findings suggest that while some efforts in deworming and sanitation have had an impact (as seen in the 37.3% negative cases), more robust interventions are needed. Future studies should explore the effectiveness of integrated control measures, including improved water sanitation and hygiene (WASH) programs, to sustainably reduce helminth infections in endemic areas.

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