

Socio-Demographic and Environmental Risk Factors Associated with Soil-Transmitted Helminth Infections Among Primary School Children in Hong Local Government Area, Adamawa State, Nigeria

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ABSTRACT

Soil-transmitted helminth (STH) infections remain an important public-health problem among school-aged children, particularly in communities with inadequate sanitation and hygiene. This study assessed the prevalence and socio-demographic and environmental factors associated with SH infections among primary school children in Hong Local Government Area (LGA), Adamawa State, Nigeria. A school-based cross-sectional study was conducted among pupils aged 3–12 years in six selected primary schools from April to September, 2024. Data were collected using structured questionnaires, while stool samples were examined using the Formol-Ether concentration technique. Data were analysed using descriptive statistics and chi-square tests at a 5% significance level. Of 380 pupils examined, 104 (27.37%) were infected. *Ascaris lumbricoides* was predominant (14.47%), followed by *Trichuris trichiura* (7.89%) and hookworm (5.00%). Prevalence was highest among pupils from households practising open defecation (36.47%) and lowest among those using water-closet facilities (17.43%). Faecal-disposal method was significantly associated with infection ($\chi^2 = 9.217$, $p = 0.010$), whereas parental occupation, water source, footwear use, deworming history, school, gender and age were not significant. The findings highlight the need for improved sanitation, sustained deworming and health education to reduce STH transmission.

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INTRODUCTION

Soil-transmitted helminths (STHs) are intestinal parasitic worms whose transmission is strongly associated with environmental contamination by human faeces. The major species of public-health importance are *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), and the hookworms *Ancylostoma duodenale* and *Necator americanus*. *A. lumbricoides* and *T. trichiura* are mainly acquired through ingestion of infective eggs from contaminated soil, food, water or hands, while hookworm infection occurs principally when larvae in contaminated soil penetrate the skin, especially among individuals who walk barefoot (World Health Organization [WHO], 2023).

STHs remain among the most common parasitic infections globally and disproportionately affect populations living in poverty and communities with inadequate water, sanitation and hygiene (WASH). WHO estimates that approximately 1.5 billion people, representing about 24% of the world's population, are infected, with the greatest burden in tropical and subtropical regions, particularly sub-Saharan Africa? More than 654 million school-age children live in areas where transmission is sufficiently intense to require preventive treatment (WHO, 2023). Infection is particularly important among schoolchildren because persistent or heavy infections may cause abdominal symptoms, diarrhoea, malnutrition, weakness, anaemia, impaired growth and poor physical development (WHO, 2023).

Agrawal *et al.* (2024), in a systematic review and meta-analysis involving schoolchildren aged 5–18 years in low- and middle-income countries, reported considerable geographical variation in STH prevalence and emphasized environmental, socioeconomic and WASH-related contributions to transmission. Thus, STH transmission is influenced by

individual characteristics as well as the environmental and social conditions in which children live.

Evidence from Nigeria demonstrates continuing transmission and geographical variation. In southwestern Nigeria, Awotokun *et al.* (2024) examined 324 schoolchildren in Ife Central and Ife East LGAs of Osun State and reported an overall prevalence of 24.4%, with *A. lumbricoides* predominant. No significant difference occurred between males and females, suggesting that infection may remain prevalent across demographic groups. In southeastern Nigeria, Aribodor *et al.* (2025) reported 35.2% prevalence among 443 adolescents in Anaocha LGA, Anambra State. *A. lumbricoides* was the most prevalent species, followed by *T. trichiura* and hookworm, while socioeconomic and knowledge-related factors were significantly associated with infection.

Similarly, Usang *et al.* (2025) investigated STH infection, associated risk factors and nutritional indices among 382 children and adolescents in Calabar, Cross River State, confirming that STHs remain an important health concern. Imalele *et al.* (2023) provided further evidence of environmental transmission in Calabar South LGA, where 54.1% of participating schoolchildren were infected and 65% of examined soil samples were contaminated with STHs. *A. lumbricoides* was prominent in both human infections and contaminated soil, emphasizing the importance of sanitation and health education.

Environmental conditions play a central role in sustaining STH transmission. Poor sanitation allows human faeces to contaminate soil, water and food. Contaminated hands and vegetables can facilitate ingestion of infective eggs, while hookworm larvae can penetrate exposed skin. Access to safe water, sanitary toilet facilities, handwashing, food hygiene

and consistent footwear use therefore reduces exposure (WHO, 2023).

Periodic deworming is another major component of STH control. WHO recommends preventive chemotherapy with anthelmintic medicines in endemic populations, with annual treatment where community prevalence exceeds 20% and twice-yearly treatment where prevalence exceeds 50% (WHO, 2023). However, preventive chemotherapy reduces worm burden without eliminating environmental conditions that permit reinfection. Sustainable control therefore requires its combination with health education, improved sanitation, safe water and hygiene interventions.

Recent Nigerian evidence demonstrates the potential impact of sustained preventive chemotherapy. Jacob *et al.* (2025) assessed school-age children in 16 LGAs of Ekiti State after three to five annual rounds of mass drug administration and reported a decline in overall STH prevalence from 30.9% to 3.9%, although *A. lumbricoides* remained predominant. Persistent geographical differences indicate the need for surveillance and targeted interventions. Schools also provide an important platform for health education, hygiene promotion and preventive chemotherapy. Obi *et al.* (2024), in their assessment of teachers involved in the Home-Grown School Feeding Programme in Enugu Metropolis, highlighted the importance of improving teachers' knowledge and preventive practices concerning STH infection.

Hong LGA of Adamawa State is predominantly rural, with agriculture constituting an important livelihood. Communities depend on different domestic water sources, while sanitation facilities and hygiene conditions vary among households. These conditions may facilitate faecal contamination and increase STH exposure among school-aged children. Understanding socio-demographic and environmental factors associated with infection is therefore essential. Although preventive chemotherapy has been implemented in many parts of Nigeria, infection may persist or recur where environmental contamination, inadequate sanitation and poor hygiene remain. WHO promotes an integrated approach combining preventive chemotherapy with health education, improved sanitation and hygiene interventions (WHO, 2023, 2024).

Consequently, this study assessed socio-demographic and environmental factors associated with STH infections among primary school children in Hong LGA, Adamawa State, Nigeria. Specifically, it examined parental occupation, household faecal-disposal practices, household water source, and footwear use, deworming history, age, gender and school attended. The findings are expected to provide local epidemiological evidence to support targeted interventions for reducing STH transmission and improving the health and well-being of schoolchildren.

MATERIALS AND METHODS

Study Area

The study was conducted in Hong Local Government Area (LGA) of Adamawa State, northeastern Nigeria. Hong LGA lies between latitude 10°13'543N and longitude 12°55'493E of the Greenwich meridian. It is bounded to the south by Song LGA, southeast by Maiha LGA, north by Borno State, east by Mubi LGA and west by Gombi LGA. Hong LGA lies within the Sudan savanna ecological zone, characterized by mountain land traversed by valleys and rivers and bordered by River Hawul and Killanyi. Vegetation consists of sparse trees, shrubs and grasses. The LGA occupies approximately 2,626 km², representing about 2.9% of Adamawa State, and had an estimated population of 169,126 in the 2006 census, comprising 83,805 males and 85,321 females (National

Population Commission, 2006). It has a tropical climate with distinct wet and dry seasons. The rainy season extends from April to October and the dry season from November to March. Annual rainfall ranges from 800–1,100 mm, while temperatures range from 20°C to 40°C. According to Adebayo (1999), inhabitants are predominantly farmers, traders and civil servants. Major crops include maize, sorghum, millet, groundnuts, beans and vegetables. Rural communities depend mainly on boreholes, wells and streams for domestic water. Sanitation varies, with some households using pit latrines or practising open defecation. The study was conducted in six selected primary schools: Dakisiri, Gashala, Kalaa, Thabu, Mijili and Uba Primary Schools.

Study Design

A school-based cross-sectional study design was adopted to investigate socio-demographic and environmental factors associated with STH infections among primary school children.

Study Population

The study population consisted of primary school pupils aged 3–12 years attending the selected schools in Hong LGA during the 2024 academic session.

Sample Size Determination

The sample size was determined using the Yamane (1967) formula:

$$n = N / [1 + N (e^2)]$$

Where:

n = sample size

N = population size (169,126)

e = level of precision (0.05)

Therefore:

$$n = 169,126 / [1 + 169,126(0.05^2)] = 399$$

The calculated sample size was 399 pupils; however, only 380 pupils had complete results.

Ethical Approval

Ethical approval was obtained from the appropriate institutional ethics committee before commencement of the research. Permission was also obtained from the Adamawa State Ministry of Education and participating schools.

Informed Consent

Written informed consent was obtained from parents or guardians. Confidentiality was maintained throughout the study, participation was voluntary, and infected pupils were referred for appropriate treatment.

Sampling Technique

Sampling involved two stages. First, Hong LGA, which has 11 wards divided into two constituencies comprising 5 and 6 wards, had the six-ward constituency purposively selected. Second, one primary school was selected from each of the six wards, giving six schools. Thus, a multistage sampling technique involving purposive and random sampling was used. Class registers served as sampling frames, and eligible pupils were randomly selected until the required sample size was achieved.

Data Collection

Data were collected using a structured questionnaire covering socio-demographic and environmental factors potentially associated with STH infection. Sociodemographic variables included age, sex, class, school, parents' educational level, parents' occupation and household size. Environmental

factors included toilet availability and use, open defecation, drinking-water source, handwashing facilities and practices, waste disposal, soil contact, walking barefoot, personal and environmental sanitation, and hygiene practices such as washing fruits and vegetables before consumption. Teachers and parents assisted with questionnaire administration where necessary.

Collection and Examination of Stool Samples

Sterile stool containers were distributed to selected pupils. Samples were collected into clean, labelled, leak-proof screw-cap containers and promptly transported to the laboratory in an insulated cold box containing ice packs. Samples were maintained at approximately 2–8°C and processed as soon as possible. Precautions were taken to prevent leakage, contamination and deterioration (WHO, 2022).

Laboratory examination was performed using the Formol-Ether Concentration Technique described by Cheesbrough (2006). Approximately 1–2 g of stool was emulsified in 10% formalin and filtered into a centrifuge tube through gauze folded into several layers. Diethyl ether was added, the mixture shaken and centrifuged at approximately 500 × g for 2–5 minutes. The supernatant and debris were discarded, and the sediment examined microscopically under ×10 and ×40 objectives for STH eggs, larvae and cysts. Identification was

based on morphological characteristics including shape, size, shell appearance and colour.

Data Analysis

Questionnaire and laboratory data were entered into Microsoft Excel and analysed using SPSS version 25.0. Frequencies and percentages summarized variables, while chi-square (χ^2) tests assessed associations between STH infection and selected socio-demographic and environmental factors. Statistical significance was accepted at $p < 0.05$.

RESULTS AND DISCUSSION

Prevalence of Soil-Transmitted Helminth Infection in Relation to Sociodemographic and Environmental Factors

Parental Occupation

Table 1 presents the prevalence of soil-transmitted helminth (STH) infection in relation to parental occupation. The highest prevalence was recorded among pupils whose parents were civil servants (30.36%), followed by those whose parents were engaged in private business (27.66%) and farming (26.52%). However, the difference was not statistically significant ($\chi^2 = 0.339$, $df = 2$, $p = 0.844$), indicating that parental occupation was not significantly associated with STH infection among the pupils.

Table 1: Prevalence of Soil-Transmitted Helminth Infection in Relation to Parental Occupation

Parents' Occupation	Examined	Infected	Prevalence (%)
Farmers	230	61	26.52
Civil Servants	56	17	30.36
Private Business	94	26	27.66
Total	380	104	27.37

$\chi^2 = 0.339$, $df = 2$, $p = 0.844$; Not significant ($p > 0.05$).

Environmental Risk Factors for STH Infection

Method of Faecal Disposal

Table 2 shows the prevalence of STH infection according to household faecal-disposal practices. Pupils from households practising open defecation recorded the highest prevalence (36.47%), followed by those using pit toilets (29.03%). The

lowest prevalence was observed among pupils whose households used water-closet facilities (17.43%). A statistically significant association was observed between method of faecal disposal and STH infection ($\chi^2 = 9.217$, $df = 2$, $p = 0.010$).

Table 2: Prevalence of Soil-Transmitted Helminth Infection in Relation to Method of Faecal Disposal

Method of Faecal Disposal	Examined	Infected	Prevalence (%)
Water Closet	109	19	17.43
Pit Toilet	186	54	29.03
Open Defecation	85	31	36.47
Total	380	104	27.37

$\chi^2 = 9.217$, $df = 2$, $p = 0.010$; Significant ($p < 0.05$).

Household Water Source

Table 3 presents the prevalence of STH infection according to household water source. Pupils whose households obtained water from boreholes recorded the highest prevalence

(30.92%), followed by streams (23.08%) and wells (19.57%). However, the association between household water source and STH infection was not statistically significant ($\chi^2 = 4.763$, $df = 2$, $p = 0.092$).

Table 3: Prevalence of Soil-Transmitted Helminth Infection in Relation to Household Water Source

Water Source	Examined	Infected	Prevalence (%)
Stream	39	9	23.08
Borehole	249	77	30.92
Well	92	18	19.57
Total	380	104	27.37

$\chi^2 = 4.763$, $df = 2$, $p = 0.092$; Not significant ($p > 0.05$).

Footwear Use

Table 4 presents the prevalence of STH infection in relation to footwear use. Pupils who always wore shoes recorded a

prevalence of 29.93%, those who did not always wear shoes recorded 27.13%, while pupils who did not wear shoes at all

recorded 24.04%. The difference was not statistically significant ($\chi^2 = 1.070$, $df = 2$, $p = 0.586$).

Table 4: Prevalence of Soil-Transmitted Helminth Infection in Relation to Footwear Use

Footwear Use	Examined	Infected	Prevalence (%)
Always Wears Shoes	147	44	29.93
Not Always	129	35	27.13
Not at All	104	25	24.04
Total	380	104	27.37

$\chi^2 = 1.070$, $df = 2$, $p = 0.586$; Not significant ($p > 0.05$).

History of Deworming

Table 5 shows the prevalence of STH infection according to pupils' recent deworming history. Pupils who reported being dewormed within the previous month had a prevalence of 27.83%, while those dewormed within the previous two

months had a prevalence of 23.65%. Pupils who could not remember their deworming status recorded the highest prevalence (38.71%). The association between deworming history and STH infection was not statistically significant ($\chi^2 = 5.439$, $df = 2$, $p = 0.066$).

Table 5: Prevalence of Soil-Transmitted Helminth Infection in Relation to History of Deworming

Deworming History	Examined	Infected	Prevalence (%)
Last Month	115	32	27.83
Last Two Months	203	48	23.65
I Don't Know	62	24	38.71
Total	380	104	27.37

$\chi^2 = 5.439$, $df = 2$, $p = 0.066$; Not significant ($p > 0.05$).

Prevalence of Soil-Transmitted Helminths among School Children in the Six Selected Primary Schools

Of the 380 stool samples examined, 104 (27.37%) were positive for soil-transmitted helminth infection. *Ascaris lumbricoides* had the highest prevalence (14.47%), followed by *Trichuris trichiura* (7.89%) and hookworm (5.00%).

Dakisiri Primary School recorded the highest prevalence (36.51%), followed by Kalaa (30.16%), Mijili (28.13%), Thabu (23.81%), Gashala (23.81%) and Uba (21.88%). The association between school and STH infection was not statistically significant ($\chi^2 = 4.687$, $df = 5$, $p = 0.455$).

Table 6: Prevalence of Soil-Transmitted Helminths among Pupils in the Six Selected Primary Schools

Primary School	Examined	Infected (%)	n	A. lumbricoides n (%)	Hookworm n (%)	T. trichiura n (%)
Dakisiri	63	23 (36.51)	14 (22.22)	4 (6.35)	5 (7.94)	
Gashala	63	15 (23.81)	7 (11.11)	4 (6.35)	4 (6.35)	
Kalaa	63	19 (30.16)	11 (17.46)	2 (3.17)	6 (9.52)	
Thabu	63	15 (23.81)	9 (14.29)	2 (3.17)	4 (6.35)	
Mijili	64	18 (28.13)	9 (14.06)	3 (4.69)	6 (9.38)	
Uba	64	14 (21.88)	5 (7.81)	4 (6.25)	5 (7.81)	
Total	380	104 (27.37)	55 (14.47)	19 (5.00)	30 (7.89)	

$\chi^2 = 4.687$, $df = 5$, $p = 0.455$; Not significant ($p > 0.05$).

Distribution of Parasites Identified

Three species of soil-transmitted helminths were identified among the infected pupils. *Ascaris lumbricoides* was the most

frequently identified parasite, accounting for 55 (52.88%) of the 104 positive pupils, followed by *Trichuris trichiura* with 30 (28.85%) and hookworm with 19 (18.27%).

Table 7: Parasites Identified and Their Prevalence and Percentage Abundance among Positive Samples

Parasite	Number Identified	Prevalence among 380 (%)	Percentage Abundance among 104 Positive Samples (%)
<i>Ascaris lumbricoides</i>	55	14.47	52.88
<i>Trichuris trichiura</i>	30	7.89	28.85
Hookworm	19	5.00	18.27
Total	104	27.37	100.00

Note: Percentage abundance = number of each parasite identified ÷ total positive samples (104) × 100.

Soil-Transmitted Helminths in Relation to Gender

Male pupils recorded a higher prevalence of STH infection (31.05%) than females (23.68%). However, the difference was not statistically significant ($\chi^2 = 2.595$, $df = 1$, $p = 0.107$).

Table 8: Prevalence of Soil-Transmitted Helminths in Relation to Gender

Gender	Examined	Infected n (%)
Male	190	59 (31.05)
Female	190	45 (23.68)
Total	380	104 (27.37)

$\chi^2 = 2.595$, $df = 1$, $p = 0.107$; Not significant ($p > 0.05$).

Soil-Transmitted Helminths in Relation to Age Group

The highest prevalence was recorded among pupils aged 7–9 years (29.80%), followed by those aged 10–12 years (26.72%). Pupils aged 3–6 years had the lowest prevalence

(24.49%). The association between age group and STH infection was not statistically significant ($\chi^2 = 0.886$, $df = 2$, $p = 0.642$).

Table 9: Prevalence of Soil-Transmitted Helminths in Relation to Age Group

Age Group (years)	Examined	Infected n (%)
3–6	98	24 (24.49)
7–9	151	45 (29.80)
10–12	131	35 (26.72)
Total	380	104 (27.37)

$\chi^2 = 0.886$, $df = 2$, $p = 0.642$; Not significant ($p > 0.05$).

Discussion**Parental Occupation and STH Infection**

The absence of a significant association between parental occupation and STH infection suggests that occupation alone may not adequately explain children's infection risk. Although occupation can indicate socioeconomic status, it does not necessarily reflect immediate environmental conditions. Families from different occupational groups may have similar access to sanitation, water, housing and health services, particularly where environmental conditions are relatively homogeneous.

This interpretation agrees with Nigerian evidence showing that socioeconomic characteristics do not consistently act as independent predictors. Aribodor *et al.* (2025), among adolescents in Anaocha, Anambra State, demonstrated that risk factors varied according to the specific socioeconomic or behavioural characteristic considered, suggesting that socioeconomic background may influence infection indirectly through sanitation, hygiene, education and environmental exposure.

Usang *et al.* (2025), studying 382 children and adolescents in Calabar, identified sanitation-related factors, particularly pit-latrines use, as associated with STH infection. This supports the view that direct environmental exposure may be more immediate than parental occupation. Agrawal *et al.* (2024) also reported substantial geographical heterogeneity in STH prevalence related to socioeconomic conditions, sanitation, water, hygiene and environmental factors rather than occupation alone. Therefore, the non-significant association does not imply that socioeconomic circumstances are unimportant but that parental occupation may have limited value as an independent measure of exposure.

The finding emphasizes investigation of household-level determinants, particularly sanitation, water handling, hygiene and environmental exposure, rather than occupational categories alone.

Method of Faecal Disposal and STH Infection

The significant relationship between faecal-disposal practices and STH infection demonstrates the importance of sanitation in transmission. Inadequate disposal allows parasite eggs and larvae to contaminate soil, household compounds, playgrounds and other areas where children may encounter infective stages.

Nigerian evidence supports this finding. Imalele *et al.* (2023), among schoolchildren in Cross River State, reported

substantial STH transmission and identified sanitation-related factors as important determinants. Their findings are relevant to the present study because communities with limited sanitation facilities may experience greater environmental contamination.

Environmental research by Imalele *et al.* (2023) further demonstrated STH contamination of children's surroundings, providing biological support for the present finding. Usang *et al.* (2025) also reported a significant association between pit-latrines use and STH infection in Calabar, showing that the presence of a toilet does not necessarily eliminate transmission when facilities are inadequate or poorly maintained.

Agrawal *et al.* (2024) emphasized improving WASH alongside preventive chemotherapy. The consistency of Nigerian and international findings indicates that sanitation remains an important modifiable determinant. Reducing open defecation, improving household and school toilets, maintaining hygienic latrines and preventing contamination of children's play environments should therefore be central to STH-control activities.

Household Water Source and STH Infection

The non-significant association between household water source and STH infection indicates that source alone may not adequately represent exposure. Although boreholes are generally improved sources, water may become contaminated during collection, transportation, storage or use. Similarly, well or stream water may not result in infection when appropriately treated and hygienically handled.

Imalele *et al.* (2023) demonstrated that water-related practices can influence STH transmission, suggesting that water quality and handling may be more relevant than source classification. Usang *et al.* (2025) also showed that transmission is influenced by multiple interacting environmental and behavioural factors. Aribodor *et al.* (2025) reported continuing transmission among adolescents despite interventions, reinforcing that infection cannot be explained by water source alone.

Agrawal *et al.* (2024) support integrated WASH interventions rather than reliance on water-source improvement alone. Thus, the relatively high prevalence among borehole users should not be interpreted as evidence that borehole water causes STH infection. Future studies should assess water treatment, collection, storage containers, storage duration and household hygiene.

Footwear Use and STH Infection

The lack of a significant association between footwear use and STH infection may reflect differences in parasite transmission. Footwear is particularly important for hookworm because larvae can penetrate skin during barefoot contact with contaminated soil, whereas *A. lumbricoides* and *T. trichiura* are mainly transmitted through ingestion of infective eggs.

This distinction is relevant because *A. lumbricoides* was predominant in the present study. Children may therefore remain exposed through contaminated hands, food, soil and water despite wearing shoes.

Imalele *et al.* (2023) demonstrated that exposure is determined by several interacting behaviours rather than footwear alone, while Usang *et al.* (2025) emphasized sanitation and other environmental and behavioural conditions. Agrawal *et al.* (2024) likewise supports combining preventive chemotherapy with WASH. Footwear therefore remains appropriate, particularly against hookworm, but should be combined with sanitation, handwashing, safe food practices and environmental hygiene.

History of Deworming and STH Infection

The absence of a significant association between recent deworming and STH infection may reflect reinfection and differences in treatment timing and effectiveness. Anthelmintic treatment removes susceptible parasites present at treatment but does not permanently protect against subsequent exposure. Children living in faecally contaminated environments may therefore become reinfected. Aribodor *et al.* (2025) reported continuing STH transmission among adolescents in Anaocha despite mass drug administration, suggesting that preventive chemotherapy alone may be insufficient where environmental sources remain. Usang *et al.* (2025) found deworming history associated with STH status, demonstrating that preventive chemotherapy can influence infection but does not eliminate other risk factors.

Agrawal *et al.* (2024) similarly emphasized combining preventive chemotherapy with improved sanitation, water and hygiene. The high prevalence among pupils unable to remember their deworming history may reflect uncertainty about treatment coverage or recall. Furthermore, the cross-sectional design could not establish whether infection occurred before treatment, whether treatment was correctly taken or whether reinfection occurred afterwards.

The findings therefore support an integrated deworming-plus-WASH strategy rather than reliance on deworming alone.

Overall Prevalence of STH Infection

The overall prevalence of 27.37% confirms active STH transmission among schoolchildren in the study area. Recent Nigerian studies demonstrate geographical variation. Imalele *et al.* (2023) reported 46.0% among 504 school-age children in Ogoja, Cross River State, identifying *A. lumbricoides*, hookworm, *T. trichiura* and *Strongyloides stercoralis*. The higher prevalence may reflect differences in sanitation, diagnostic methods, parasite composition and local transmission intensity.

Usang *et al.* (2025) reported 28.8% among 382 children and adolescents in Calabar, closely approximating the present finding and confirming substantial transmission in southern Nigeria. *A. lumbricoides* was also predominant.

Awotokun *et al.* (2024) reported 24.4% among 324 schoolchildren in Ife Central and Ife East, Osun State, which was lower than the present prevalence but confirms

transmission across ecological zones. South-East Nigerian studies have also documented continuing infection despite preventive interventions.

Internationally, Agrawal *et al.* (2024) reported a pooled prevalence of 37.16% among schoolchildren aged 5–18 years in low- and middle-income countries. The present prevalence is lower but remains epidemiologically important. Differences between studies may reflect ecological conditions, sanitation, diagnostic techniques, age distribution, sample size, deworming coverage, rainfall, soil characteristics and sampling period.

Distribution of Parasites Identified

The predominance of *A. lumbricoides* is consistent with recent Nigerian studies. Usang *et al.* (2025) identified *A. lumbricoides* as the most prevalent species in Calabar, followed by *T. trichiura* and hookworm. Awotokun *et al.* (2024) similarly reported *A. lumbricoides* as dominant in Osun State, with prevalence of 22.2%, while hookworm was 3.7%.

In contrast, Imalele *et al.* (2023) reported a somewhat different pattern in Ogoja, where hookworm had slightly higher prevalence than *A. lumbricoides* and *Strongyloides stercoralis* contributed substantially. Such differences demonstrate the influence of ecological and behavioural factors on parasite composition.

The predominance of *A. lumbricoides* may partly reflect the environmental persistence of its eggs. Where human faeces contaminate soil, infective eggs can remain and facilitate repeated exposure, which is particularly relevant because inadequate faecal disposal was significantly associated with infection. Agrawal *et al.* (2024) similarly identified *A. lumbricoides* as the predominant STH among schoolchildren in low- and middle-income countries.

STH Infection According to School

Variation in prevalence across the six schools, despite the absence of statistical significance, suggests that differences in school and community environments may exist but were insufficient to establish an association. Possible explanations include differences in toilet availability, water supply, environmental cleanliness, waste disposal, hygiene practices and household sanitation. Since the relationship was not significant, attendance at a particular school cannot be regarded as an independent determinant.

Usang *et al.* (2025), studying four primary schools in Calabar, documented continuing STH transmission and emphasized sanitation and hygiene improvements. Environmental research in Cross River State also demonstrated contamination of school surroundings with STH eggs and larvae (Imalele *et al.*, 2023). Awotokun *et al.* (2024) found STH infection among pupils in both public and private schools in Osun State with relatively similar prevalence. Agrawal *et al.* (2024) reported geographical heterogeneity in prevalence associated with environmental and socioeconomic differences. Thus, the non-significant result does not mean that the schools have identical environmental conditions; rather, differences were insufficient to demonstrate statistical association.

Gender and STH Infection

Male pupils had higher prevalence than females, although the difference was not significant. This may reflect differences in outdoor activities or soil exposure, but sex alone cannot be regarded as an independent determinant.

Usang *et al.* (2025) reported prevalence of 30.2% among males and 27.7% among females in Calabar. Awotokun *et al.*

(2024) similarly found higher prevalence among males, although the difference was not significant. Other Nigerian populations have reported differing sex patterns, suggesting that gender has no uniform biological effect and that behavioural exposure, hygiene, outdoor activities and cultural roles may be more relevant.

Agrawal *et al.* (2024) demonstrated substantial population-level variation, supporting the context-dependent nature of sex-specific patterns. Consequently, STH-control programmes should target both male and female pupils while considering behaviours that may produce differential exposure.

Age Group and STH Infection

The absence of a significant association between age and STH infection indicates that infection occurred across all age groups. Although prevalence varied, age was not an independent predictor.

Usang *et al.* (2025) observed relatively higher infection among participants aged 10 years and above but also documented transmission among younger children. Imalele *et al.* (2023) reported significantly higher parasitic infection among children aged 5–7 years in Ogoja, contrasting with the Calabar pattern. Awotokun *et al.* (2024) likewise demonstrated continuing STH infection among children aged 5–12 years.

These differences suggest that age-related exposure is influenced by local environmental and behavioural conditions. Younger children may have greater hand-to-mouth behaviour and soil contact during play, whereas older children may experience increased outdoor or domestic exposure. These opposing pathways may explain the absence of a significant age association in the present study.

CONCLUSION

STH infection remains prevalent among primary school children in Hong LGA, with an overall prevalence of 27.37%. *Ascaris lumbricoides* was predominant, while faecal-disposal practice was the only factor significantly associated with infection. Improved sanitation, elimination of open defecation, regular deworming and health education are therefore needed to reduce STH transmission.

RECOMMENDATIONS

Based on the findings, the following recommendations are made:

- i. Government, local authorities and development partners should prioritize improved sanitation facilities in schools and communities.
- ii. Community-based sanitation programmes should be strengthened to discourage open defecation, while public awareness campaigns should emphasize the health risks of indiscriminate human-waste disposal.
- iii. Periodic mass deworming programmes should be sustained and expanded to achieve adequate coverage of school-aged children and reduce infection prevalence and intensity.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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