Knowledge of the Relationship between Household Sanitation and Helminth Infection among Secondary School Students in Isiala Mbano LGA, Imo State

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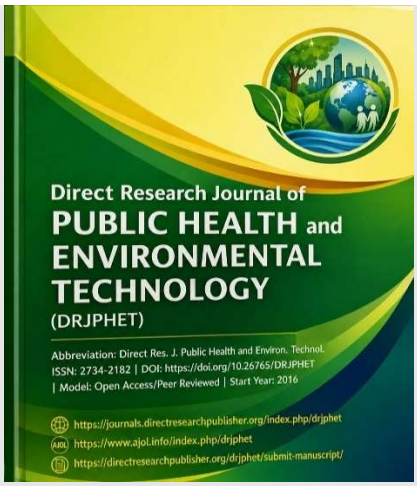
ABSTRACT

The present study investigated knowledge of the link between household sanitation and the prevalence of helminth infections among selected secondary schools in Isiala Mbano Local Government Area, Imo State. Using a cross-sectional descriptive design, the study employed a multistage sampling technique to recruit 384 students from five political wards. Data collection used a structured questionnaire to assess sociodemographic characteristics, sanitation facilities, and health knowledge, and included laboratory analysis of stool samples to determine infection status. Results indicated an overall prevalence of 30.5% (117 students), with Ascaris lumbricoides (52.1%) the predominant parasite, followed by hookworm (33.3%) and Trichuris trichiura (14.5%). Household sanitation assessment revealed that 31.3% of respondents relied on unimproved pit latrines or practiced open defecation, while 29.4% depended on untreated river or rainwater. Crucially, only 21.1% of students had access to soap and water for handwashing. Although 72.1% of participants correctly identified swallowing eggs as the primary infection route, a significant gap between knowledge and practice was observed, as 47.1% reported deworming only when symptoms appeared. Furthermore, 28.4% of students perceived open defecation merely as an environmental nuisance rather than a direct health risk. Inferential statistical analysis using Chi-Square Tests of Independence showed no statistically significant association between primary toilet facility and helminth infection status ($X^2 = 0.12$, $df = 3$, $p = 0.990$), handwashing materials and infection status ($X^2 = 6.49$, $df = 3$, $p = 0.090$), or paternal educational attainment and environmental health knowledge ($X^2 = 0.50$, $df = 3$, $p = 0.919$). These findings indicate that poor sanitation conditions and misconceptions were evident, although the tested categorical associations did not reach the 0.05 level of statistical significance. The study concludes that high infection rates appear to be sustained by poor sanitation infrastructure and specific misconceptions despite general health awareness. Consequently, implementation of targeted school-based health education programs focusing on transmission dynamics and urgent government investment in water, sanitation, and hygiene facilities are recommended to effectively break the cycle of reinfection.

Keywords: *Household sanitation, prevalence, helminth infection, Soil-transmitted helminths wash*



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INTRODUCTION

Soil-transmitted helminth (STH) infections are parasitic diseases caused mainly by intestinal nematodes, including *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms such as *Necator americanus* and *Ancylostoma duodenale* (World Health Organization, 2023; Obi et al., 2024). They are classified among neglected tropical diseases and are closely linked to poverty, poor sanitation, and unsafe water access in tropical and subtropical communities (Chen et

al., 2024; World Health Organization, 2023). Recent global estimates indicate that STH infections remain widespread, with WHO estimating more than 1.5 billion people infected, while a Global Burden of Disease analysis estimated about 642.7 million cases and 1.38 million disability-adjusted life years in 2021 (Chen et al., 2024; World Health Organization, 2023). School-aged children and adolescents remain priority populations because repeated exposure to contaminated soil and water can sustain infection and adversely affect nutrition, physical growth, cognition, and school participation (Agrawal et al., 2024; Obi et al., 2024; Usang et al., 2025; World Health Organization, 2023).

Sub-Saharan Africa remains one of the most affected regions, and Nigeria continues to report substantial STH transmission in both school and community settings (Adenusi et al., 2024; Agrawal et al., 2024). Recent Nigerian studies report STH prevalence of 46.0% among school-aged children in Ogoja, Cross River State, 35.2% among adolescents in Anaocha, Anambra State, 28.8% among children and adolescents in Calabar, and 38.2% in a community-based survey in Apojola, Ogun State (Imalele et al., 2023; Aribodor et al., 2025; Usang et al., 2025; Adenusi et al., 2024). Although mass drug administration remains a major control strategy, treatment alone cannot fully interrupt transmission where reinfection continues through contaminated soils, unsafe water, inadequate sanitation, and persistent hygiene gaps (Akinsolu et al., 2023; Lebu et al., 2023).

Household sanitation in this context refers to safe excreta disposal, water access, hand hygiene, and related water, sanitation, and hygiene (WASH) conditions that reduce environmental contamination and pathogen exposure (Wolf et al., 2023; World Health Organization, 2023). Soil-transmitted helminths are transmitted when eggs or larvae from infected faeces contaminate soil, food, water, hands, or fomites. *Ascaris* and *Trichuris* infections are commonly acquired through ingestion of infective eggs, whereas hookworm larvae penetrate the skin, particularly during barefoot contact with contaminated soil (Bonja et al., 2026; World Health Organization, 2023). Recent global burden evidence attributes soil-transmitted helminthiasis to unsafe WASH exposure and demonstrates that improvements in WASH services would substantially reduce disease burden (Wolf et al., 2023). Poor sanitation and hygiene create environmental reservoirs of infective stages and facilitate rapid reinfection following deworming (Edoa et al., 2024; Lebu et al., 2023). However, improvements in sanitation infrastructure alone are insufficient unless individuals understand how sanitation behaviours influence parasite transmission. Knowledge, attitudes, and practices affect toilet use, disposal of children's faeces, handwashing with soap, footwear use, food hygiene, and acceptance of routine deworming (Abdissa et al., 2024; Akinsolu et al., 2023; Obi et al., 2024). Evidence from school- and community-based studies indicates that health education can improve STH-related knowledge and preventive practices; however, knowledge–practice gaps persist where access to soap, safe water, sanitation facilities, and deworming services remains inadequate (Obi et al., 2024; Xaybouaphanh et al., 2025). Secondary school students therefore represent an important target population for sanitation-linked health education because they can understand transmission pathways and potentially influence hygiene practices within their households and communities (Aribodor et al., 2025; Xaybouaphanh et al., 2025).

Despite these advances, most Nigerian studies have primarily focused on estimating the prevalence of STH infections or identifying associated risk factors, with limited attention to students' knowledge of the relationship between household sanitation and laboratory-confirmed helminth infections within the same population. Furthermore, there is a paucity of published evidence from Isiala Mbano Local Government Area, Imo State, where context-specific epidemiological and behavioural data are needed to inform effective control strategies. Addressing this gap will provide evidence to support integrated interventions that combine preventive chemotherapy with health education and improved household sanitation.

Aim of the Study

This study aimed to assess the knowledge of the relationship between household sanitation and the prevalence of helminth infections among secondary school students in Isiala Mbano Local Government Area, Imo State.

Specific Objectives

The specific objectives were to:

1. Determine the prevalence of helminth infections among secondary school students in Isiala Mbano Local Government Area.
2. Assess the household sanitation facilities and hygiene practices of the students' households.
3. Assess the students' general knowledge regarding helminth infections and their prevention.
4. Assess the students' knowledge of the relationship between household sanitation and helminth transmission.

METHODOLOGY

Area of Study

The study was conducted in Isiala Mbano Local Government Area (LGA) of Imo State, southeastern Nigeria. Isiala Mbano LGA is situated northeast of Owerri, the state capital, and occupies approximately 166 km². It lies between latitudes 5°37′N and 5°45′N and longitudes 7°00′E and 7°22′E, with its administrative headquarters at Umuelemai. The LGA is bordered by Onuimo and Nwangele LGAs to the north, Ehime Mbano LGA to the east, and Ikeduru and Mbaitoli LGAs to the south. The area is predominantly rural, with farming as the major occupation. Major crops cultivated include cassava, yam, maize, cocoyam, plantain, and oil palm. The widespread

distribution of secondary schools and the prevailing environmental and sanitation conditions make the area suitable for investigating the relationship between household sanitation and helminth infections among secondary school students.

Research Design

This study adopted an analytical cross-sectional research design. The design was appropriate because it enabled the determination of the prevalence of helminth infections while simultaneously assessing household sanitation conditions and students' knowledge at a single point in time. It also permitted the examination of associations between selected sanitation variables, knowledge variables, and laboratory-confirmed helminth infection status.

Population of the Study

The target population comprised all students enrolled in Junior Secondary School (JSS1–JSS3) and Senior Secondary School (SSS1–SSS3) in the selected secondary schools within Isiala Mbano Local Government Area, Imo State.

Eligible participants were students who were registered in the selected schools, present during data collection, and whose parents or legal guardians provided written informed consent in addition to the students' assent. Students who were severely ill, unable to communicate effectively, or whose parents or guardians declined consent were excluded from the study.

Sample and Sample Size

The study population was treated as unknown; therefore, the sample size was determined using the standard formula for estimating a single population proportion:

$$n = \frac{Z^2 pq}{e^2}$$

Where:

- n = required sample size
- Z = standard normal deviate (1.96 at 95% confidence level)
- p = estimated prevalence (0.5)
- q = 1 − p = 0.5
- e = margin of error (0.05)

Thus,

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2} = 384.16$$

The calculated sample size was approximated to 384 students, which constituted the final sample size for the study.

Sampling Technique

A multistage sampling procedure involving both probability and non-probability sampling techniques was employed. In the first stage, five political wards were selected from the twelve wards in Isiala Mbano LGA using simple random sampling by balloting. The selected wards were Osu-Achara, Umuozu, Obollo, Osuama/Anara, and Osu-Owerre II.

In the second stage, one public secondary school was purposively selected from each selected ward based on accessibility, administrative approval, and the availability of eligible students. The selected schools were Osu-Achara Girls Secondary School, Umuozu Secondary School, Obollo Secondary Technical School, Community Secondary School, Anara, and Community School Isiama. In the third stage, consecutive sampling was used to recruit eligible students from each selected school until the required sample size of 384 participants was attained. The use of purposive and consecutive sampling at the later stages should be considered when interpreting the generalizability of the study findings.

Instrument for Data Collection

Two instruments were used for data collection. The first instrument was a structured researcher-developed questionnaire designed to obtain information relating to objectives 2, 3, and 4. The questionnaire consisted of four sections:

- **Section A:** Sociodemographic characteristics
- **Section B:** Household sanitation facilities and hygiene practices
- **Section C:** General knowledge of helminth infections
- **Section D:** Knowledge of the relationship between household sanitation and helminth transmission

The second instrument was a laboratory data sheet used to record the findings from parasitological examination of stool specimens, thereby addressing Objective 1 on the prevalence of helminth infections.

Validity of Instrument

Content validity of the questionnaire was established through expert review by the research supervisor. The questionnaire was critically examined to ensure that each item was relevant, clearly worded, and adequately addressed the study objectives. Recommendations arising from the review were incorporated into the final version of the instrument.

Reliability of Instrument

The reliability of the questionnaire was established using the test-retest method. The instrument was pretested among 20 secondary school students in Ehime Mbano Local Government Area, who possessed characteristics similar to those of the study population but were not included in the main study.

The questionnaire was re-administered to the same participants after an interval of two weeks, and responses from both administrations were correlated using Pearson's Product-Moment Correlation Coefficient. A correlation coefficient of 0.70 or above was considered indicative of acceptable reliability.

Ethical Clearance

Ethical approval for this study was obtained from the Health Research Ethics Committee of Abia State University, Uturu. The institution with which the principal investigator was academically affiliated. Administrative permission to conduct the study was subsequently obtained from the Imo State Ministry of Education and the management of each participating secondary school before data collection commenced. Written informed consent was obtained from parents or legal guardians, while written assent was obtained from all participating students. Participation was entirely voluntary, and respondents were informed of the study objectives, procedures, potential risks and benefits, confidentiality measures, and their right to withdraw from the study at any time without any adverse consequences. Participant anonymity was maintained by assigning identification codes rather than recording names, and all data were treated confidentially. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki governing research involving human participants.

Method of Data Collection

Following ethical approval and administrative permission, the researcher and trained research assistants visited each of the selected secondary schools for data collection. After obtaining parental consent and students' assent, the structured questionnaire was administered to the participants in their classrooms to obtain information on their sociodemographic characteristics, household sanitation facilities, hygiene practices, and knowledge of helminth infections.Each participant was subsequently p rovided with a clean, labelled, wide-mouthed stool specimen container together with instructions on proper specimen collection. Stool specimens were collected on the same day and transported to the laboratory for parasitological examination. The laboratory findings were documented using the laboratory data sheet.

Method of Data Analysis

Data obtained from the questionnaires and laboratory data sheets were checked for completeness, coded, and entered into the Statistical Package for the Social Sciences (IBM SPSS Statistics) version 27.0 for analysis. Descriptive statistics, comprising frequencies and percentages, were used to summarize participants' sociodemographic characteristics, determine the prevalence of helminth infections, describe household sanitation facilities and hygiene practices, and assess responses to the knowledge questions. Responses to questionnaire items were coded according to the predefined response options. For inferential analysis, selected variables were recategorized where necessary to ensure adequate cell counts and satisfy the assumptions of the Chi-square test. Specifically, the environmental health knowledge variable used in the association analysis was collapsed into analytically meaningful categories prior to cross-tabulation while preserving the substantive interpretation of the responses. Chi-square tests of independence were used to examine associations between household sanitation facilities and laboratory-confirmed helminth infection status, handwashing materials and laboratory-confirmed helminth infection status, and paternal educational attainment and environmental health knowledge. Statistical significance was determined at a p-value of less than 0.05.

RESULTS

This section presents the findings of the study using descriptive and inferential statistics. Descriptive statistics, including frequencies and percentages, were used to summarize the respondents' sociodemographic characteristics, prevalence of helminth infections, household sanitation conditions, and knowledge-related variables. Chi-square tests of independence were used to examine associations between selected study variables and laboratory-confirmed helminth infection status.

Table 1: Socio-Demographic Profile of the Respondents

Variables	Frequency	Percentage
Age Range		
10 – 12 years	67	17.4%
13 – 15 years	149	38.8%
16 – 18 years	137	35.7%
19 years and above	31	8.1%
Class/Grade Level		
Junior Secondary School (JSS 1 – JSS 3)	161	41.9%
Senior Secondary School (SSS 1 – SSS 3)	223	58.1%
Father's Highest Educational Qualification		
No formal education	41	10.7%
Primary School Certificate (FSLC)	97	25.3%
Secondary School Certificate (WAEC/NECO)	159	41.4%
Tertiary Education (OND/HND/B.Sc/PhD)	87	22.6%
Parents' Primary Occupation		
Civil Servant / Government Employee	73	19.0%
Trader / Business Owner	131	34.1%
Farmer / Artisan	157	40.9%
Unemployed / Retired	23	6.0%
Household Size		
1 – 3 people	39	10.2%
4 – 6 people	183	47.7%
7 – 9 people	119	31.0%
10 people and above	43	11.2%
Total	384	100.0%

Source: Field Survey, 2026

Table 1 presents the socio-demographic characteristics of the respondents. Of the 384 students surveyed, 149

(38.8%) were aged 13–15 years, 137 (35.7%) were aged 16–18 years, 67 (17.4%) were aged 10–12 years, and 31 (8.1%) were aged 19 years or older. A total of 223 (58.1%) respondents were in Senior Secondary School (SSS1–SSS3), while 161 (41.9%) were in Junior Secondary School (JSS1–JSS3). Regarding fathers' educational attainment, 159 (41.4%) had completed secondary education, 97 (25.3%) had primary education, 87 (22.6%) had tertiary education, and 41 (10.7%) had no formal education. In terms of parents' primary occupation, 157 (40.9%) were farmers or artisans, 131 (34.1%) were traders or business owners, 73 (19.0%) were civil servants or government employees, and 23 (6.0%) were unemployed or retired. Household size ranged from 1 to more than 10 persons, with 183 (47.7%) respondents living in households comprising 4–6 persons, 119 (31.0%) in households of 7–9 persons, 43 (11.2%) in households of 10 or more persons, and 39 (10.2%) in households of 1–3 persons.

Table 2: Prevalence and Distribution of Helminth Infections among Students

Variables	Frequency	Percentage
Final Diagnosis		
Positive for Helminth Infection	117	30.5%
Negative for Helminth Infection	267	69.5%
Specific Parasite Identified (Among Positives)		
Ascaris lumbricoides (Roundworm)	61	52.1%
Hookworm (Ancylostoma / Necator)	39	33.3%
Trichuris trichiura (Whipworm)	17	14.5%
Total	117	100.0%

Source: Field Survey, 2026

Table 2 presents the prevalence and distribution of helminth infections among the respondents. Of the 384 students examined, 117 (30.5%) tested positive for helminth infection, whereas 267 (69.5%) tested negative. Among the 117 infected students, *Ascaris lumbricoides* was identified in 61 (52.1%), hookworm (*Ancylostoma*/*Necator*) in 39 (33.3%), and *Trichuris trichiura* in 17 (14.5%).

Table 3: Status of Household Sanitation Facilities and Hygiene Practices

Variables	Frequency	Percentage
Primary Toilet Facility		
Water closet connected to a septic tank	101	26.3%
Improved Pit latrine (with concrete slab)	163	42.4%
Unimproved Pit latrine (open pit)	89	23.2%
Open defecation (Bush, Stream, Field)	31	8.1%
Primary Water Source		
Piped water / Borehole in compound	93	24.2%
Public well or borehole outside	141	36.7%
River, Stream, or Rainwater	113	29.4%
Water vendors	37	9.6%
Solid and Wastewater Disposal		
Waste management agency / Incinerator	41	10.7%
Buried in a pit within compound	123	32.0%
Dumped in open pile or bush	149	38.8%
Thrown into river or drainage	71	18.5%
Handwashing Materials at Toilet		
Clean water and Soap	81	21.1%
Clean water only	167	43.5%
Shared bowl of water	97	25.3%
No materials available	39	10.2%
Total	384	100.0%

Source: Field Survey, 2026

Table 3 presents the household sanitation facilities and hygiene practices reported by the respondents. Regarding toilet facilities, 163 (42.4%) used improved pit latrines, 101 (26.3%) used water closets connected to septic tanks, 89 (23.2%) used unimproved pit latrines, and 31 (8.1%) practiced open defecation. For household water sources, 141 (36.7%) obtained water from public wells or boreholes outside their compounds, 113 (29.4%) relied on rivers, streams, or rainwater, 93 (24.2%) had access to piped water or boreholes within their compounds, and 37 (9.6%) obtained water from vendors. With respect to waste disposal, 149 (38.8%) reported dumping waste in open piles or bushes, 123 (32.0%) buried waste within their compounds, 71 (18.5%) disposed of waste in rivers or drainage channels, and 41 (10.7%) used waste management agencies or incinerators. Regarding handwashing materials, 167 (43.5%) reported having clean water only, 97 (25.3%) used a shared bowl of water, 81 (21.1%) had both clean water and soap available, and 39 (10.2%) reported having no handwashing materials available.

Table 4: General Knowledge of Helminth Infections and Preventive Measures

Variables	Frequency	Percentage
Primary Way of Infection		
Mosquito or insect bites	43	11.2%
Swallowing eggs in food/water/dirt	277	72.1%
Spiritual attacks or curses	19	5.0%
Eating too much sugar or sweets	45	11.7%
Set of Symptoms		
High fever and shivering only	51	13.3%
Abdominal pain, swollen belly, blood in stool	269	70.0%
Persistent headache and blurred vision	37	9.6%
Skin rash and joint pains only	27	7.0%
Most Effective Treatment Method		
Anthelmintic drugs (Deworming tablets)	283	73.7%
Herbal mixtures (Agbo)	67	17.5%
Spicy foods to burn worms	21	5.5%
Doing nothing	13	3.4%
Frequency of Deworming		
Once every 3 to 6 months	139	36.2%
Only when symptoms appear	181	47.1%
Once every few years	41	10.7%
Deworming is not necessary	23	6.0%
Total	384	100.0%

Source: Field Survey, 2026

Table 4 presents the respondents' general knowledge of helminth infections and preventive measures. Regarding the primary route of infection, 277 (72.1%) identified swallowing eggs in contaminated food, water, or soil, while 45 (11.7%) attributed infection to eating too much sugar or sweets, 43 (11.2%) to mosquito or insect bites, and 19 (5.0%) to spiritual attacks or curses. For the recognition of symptoms, 269 (70.0%) identified abdominal pain, swollen abdomen, and blood in stool, whereas 51 (13.3%) selected high fever and shivering only, 37 (9.6%) selected persistent headache and blurred vision, and 27 (7.0%) selected skin rash and joint pains only. Regarding treatment, 283 (73.7%) identified anthelmintic drugs as the most effective treatment method, while 67 (17.5%) selected herbal mixtures, 21 (5.5%) selected spicy foods, and 13 (3.4%) indicated that no treatment was

Table 5: Knowledge of the Link between Household Sanitation and Helminth Transmission

Variables	Frequency	Percentage
Why Open Defecation Spreads Worms		
Eggs in feces wash into soil and water	227	59.1%
Environment smells bad and untidy	109	28.4%
Attracts dangerous wild animals	31	8.1%
Does not cause worms	17	4.4%
Reason for Washing Hands with Soap		
Make hands smell nice and fresh	43	11.2%
Remove microscopic eggs and bacteria	247	64.3%
Follow rules set by parents/teachers	61	15.9%
Remove visible dirt only	33	8.6%
Barefoot Walking and Hookworm Link		
Cold soil causes stomach cramps	63	16.4%
Larvae bore directly through the skin	193	50.3%
Dirt enters through toenails	97	25.3%
No connection to infections	31	8.1%
Impact of Improper Disposal of Child Feces		
No effect; child feces are harmless	39	10.2%
Fertilizer for nearby crops	67	17.4%
Contaminates soil where children play	219	57.0%
Attracts flies but no disease	59	15.4%
Total	384	100.0%

Source: Field Survey, 2026

Table 6: Inferential Associations with Helminth Infection Status and Knowledge

Variables Tested	Chi-Square (X^2)	Degrees of Freedom (df)	p-value	Significance
Household Toilet Facility vs. Infection Status	0.12	3	0.990	Not Significant
Handwashing Materials vs. Infection Status	6.49	3	0.090	Not Significant
Paternal Education vs. Environmental Health Knowledge	0.50	3	0.919	Not Significant

Source: Field Survey, 2026

necessary. Concerning the recommended frequency of deworming, 181 (47.1%) reported that deworming should be undertaken only when symptoms appear, 139 (36.2%) indicated every 3–6 months, 41 (10.7%) reported once every few years, and 23 (6.0%) stated that deworming is not necessary.

Table 5 presents the respondents' knowledge of the relationship between household sanitation and helminth transmission. Regarding open defecation, 227 (59.1%) reported that worm eggs in faeces wash into the soil and water, while 109 (28.4%) indicated that open defecation mainly causes unpleasant odour and environmental untidiness. Thirty-one (8.1%) respondents reported that it attracts dangerous wild animals, whereas 17 (4.4%) indicated that open defecation does not cause worm infections. For hand hygiene, 247 (64.3%) reported that washing hands with soap removes microscopic eggs and bacteria, 61 (15.9%) indicated that it is done to follow rules set by parents or teachers, 43 (11.2%) reported that it makes the hands smell fresh, and 33 (8.6%) stated that it is only necessary for removing visible dirt.

Regarding hookworm transmission, 193 (50.3%) reported that hookworm larvae penetrate the skin during barefoot walking, while 97 (25.3%) indicated that dirt enters through the toenails. Sixty-three (16.4%) respondents reported that cold soil causes stomach cramps, whereas 31 (8.1%) reported that barefoot walking has no relationship with hookworm infection.

With respect to the disposal of children's faeces, 219 (57.0%) reported that improper disposal contaminates soil where children play, 67 (17.4%) regarded children's faeces as fertilizer for nearby crops, 59 (15.4%) reported that it attracts flies without causing disease, and 39 (10.2%) considered children's faeces to be harmless. Table 6 presents the results of the Chi-square tests examining the association between selected variables and laboratory-confirmed helminth infection status, as well as environmental health knowledge. There was no statistically significant association between household toilet facility and helminth infection status ($\chi^2 = 0.12$, df = 3, $p = 0.990$). Similarly, handwashing materials were not significantly associated with helminth infection status ($\chi^2 = 6.49$, df = 3, $p = 0.090$). In addition, no statistically significant association was observed between fathers' educational attainment and environmental health knowledge ($\chi^2 = 0.50$, df = 3, $p = 0.919$). At the 5% level of significance, the null hypothesis was therefore not rejected for any of the associations examined.

DISCUSSION

This study assessed the prevalence of helminth infections, household sanitation conditions, and knowledge of helminth transmission and prevention among secondary school students in selected schools in Isiala Mbano Local Government Area, Imo State. The discussion interprets the findings in relation to the study objectives and compares them with findings from previous studies to highlight areas of agreement and divergence within the existing body of evidence.

Research Question 1: What is the prevalence of helminth infections among students in selected secondary schools in Isiala Mbano Local Government Area, Imo State?

The study found that 30.5% of the respondents tested positive for helminth infection. Among infected students, *Ascaris lumbricoides* was the most frequently identified parasite (52.1%), followed by hookworm (33.3%) and *Trichuris trichiura* (14.5%). The predominance of *A. lumbricoides* is consistent with the epidemiology of soil-transmitted helminth infections in school-aged children, where faecal contamination of the environment facilitates transmission. These findings are comparable with reports from other parts of Nigeria, including Calabar (28.8%) (Usang et al., 2025), Anaocha (35.2%) (Aribodor et al., 2025), and Ogun State (38.2%) (Adenusi et al., 2024). The prevalence observed in the present study is lower than the 46.0% reported in Ogoja (Imalele et al., 2023) and the 41.1% reported among schoolchildren in Southern Ethiopia (Bonja et al., 2026). Variations in prevalence across studies may reflect differences in environmental conditions, sanitation practices, deworming coverage, and study populations.

Research Question 2: What is the status of household sanitation facilities and practices among students' households in selected secondary schools in Isiala Mbano Local Government Area, Imo State?

The findings indicate that improved pit latrines were the most commonly reported household toilet facility (42.4%), while approximately one-third of respondents reported using unimproved pit latrines or practising open defecation. A considerable proportion of respondents also relied on rivers, streams, or public water sources for household water supply, disposed of waste in open piles or drainage channels, and reported limited availability of soap and water for handwashing. These findings suggest the presence of sanitation and hygiene gaps within the study area. Similar observations have been reported in other Nigerian studies, where inadequate sanitation facilities, poor waste disposal practices, and limited access to safe water were associated with environments favourable for soil-transmitted helminth transmission (Adenusi et al., 2024; Imalele et al., 2023; Usang et al., 2025). The World Health Organization (2023) also identifies improvements in water, sanitation, hygiene, and regular deworming as essential components of sustainable helminth control.

Research Question 3: What is the knowledge of helminth infections and preventive measures among students in selected secondary schools in Isiala Mbano Local Government Area, Imo State?

The responses indicate that many students correctly identified the faecal–oral route as the primary mode of helminth transmission, recognised common symptoms of infection, and identified anthelmintic drugs as the appropriate treatment. However, nearly half of the respondents reported that deworming should only occur when symptoms appear, indicating a gap in knowledge regarding preventive chemotherapy. This pattern suggests that while respondents demonstrated correct knowledge on several aspects of helminth infection, misconceptions remain regarding recommended preventive practices. Similar findings have been reported by Obi et al. (2024), who observed relatively good knowledge but lower preventive practice among school personnel. Akinsolu et al. (2023) also reported that misconceptions and parental concerns contributed to reduced uptake of mass drug administration programmes. These findings highlight the need for health education programmes that strengthen understanding of routine preventive deworming alongside knowledge of transmission and treatment.

Research Question 4: What is the knowledge of the relationship between household sanitation and helminth infections among students in selected secondary schools in Isiala Mbano Local Government Area, Imo State?

The study found that many respondents correctly recognised that open defecation contributes to helminth transmission through contamination of soil and water, understood the importance of handwashing with soap, and identified skin penetration as the route of hookworm infection. Nevertheless, misconceptions were observed regarding the consequences of open defecation, hookworm transmission, and the disposal of children's faeces. Similar findings have been reported in studies from Nigeria and other low- and middle-income settings, where incomplete understanding of sanitation-related transmission pathways has been associated with persistent risk behaviours (Abdissa et al., 2024; Aribodor et al., 2025; Obi et al., 2024). Strengthening school- and community-based health education programmes that emphasise safe sanitation, hand hygiene, footwear use, and proper disposal of faeces may help improve knowledge of transmission pathways and support helminth prevention. The Chi-square analysis showed no statistically significant association between household toilet facility and laboratory-confirmed helminth infection status ($\chi^2 = 0.12$, $p = 0.990$). Similarly, the association between availability of handwashing materials and helminth infection status was not statistically significant ($\chi^2 = 6.49$, $p = 0.090$). In addition, no statistically significant association was observed between fathers' educational attainment and students' environmental health knowledge ($\chi^2 = 0.50$, $p = 0.919$). These findings indicate that the variables examined independently were not significantly associated with the study outcomes within this sample. Similar observations have been reported in some school-based studies where individual household characteristics alone did not explain variations in helminth infection,

suggesting that transmission is influenced by multiple environmental, behavioural, and contextual factors (Akinsolu et al., 2023; Lebu et al., 2023; Usang et al., 2025).

Conclusion

The study found a 30.5% prevalence of helminth infection among secondary school students in selected schools in Isiala Mbano Local Government Area, with *Ascaris lumbricoides* being the most frequently identified parasite. Although many respondents demonstrated correct knowledge of the transmission, symptoms, and treatment of helminth infections, misconceptions regarding preventive deworming and sanitation-related transmission pathways were identified. The findings also revealed gaps in household sanitation and hygiene practices, including the use of unimproved sanitation facilities, unsafe waste disposal methods, and limited availability of soap and water for handwashing. However, the Chi-square analysis did not demonstrate statistically significant associations between the selected household sanitation variables and laboratory-confirmed helminth infection status or between fathers' educational attainment and environmental health knowledge. Overall, the findings highlight the continued need for integrated helminth control strategies that combine regular deworming, improved water, sanitation and hygiene (WASH) interventions, and sustained health education for school-aged children.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed:

1. The Imo State Ministry of Health should strengthen routine school-based deworming programmes for secondary school students in line with national and World Health Organization recommendations.
2. The Ministry of Education should integrate comprehensive health education on helminth transmission, prevention, sanitation, and hygiene into the secondary school curriculum.
3. Local Government Authorities should strengthen community sanitation programmes by promoting the use of improved household sanitation facilities and discouraging open defecation.
4. School authorities should ensure the continuous availability of safe water, functional handwashing facilities, and soap within school premises to encourage appropriate hygiene practices.
5. Parents and caregivers should be encouraged through community health education to provide improved household sanitation facilities and support regular deworming of school-aged children.
6. Community-based health promotion programmes should address misconceptions regarding helminth transmission, proper disposal of children's faeces, hand hygiene, footwear use, and the importance of preventive deworming.
7. Future studies should incorporate broader environmental and behavioural factors, including school sanitation conditions, water quality, and community sanitation practices, to provide a more comprehensive understanding of factors associated with helminth transmission.

LIMITATIONS OF THE STUDY

This study has some limitations that should be considered when interpreting the findings. First, although a multistage sampling approach was employed, the final stage of participant recruitment used consecutive sampling, a non-probability sampling technique, which may limit the generalizability of the findings to all secondary school students in Isiala Mbano Local Government Area. Second, information on household sanitation facilities, hygiene practices, and deworming behaviour was obtained through self-report and may therefore be subject to recall bias and social desirability bias. Third, the analytical cross-sectional design provides a snapshot of exposures and outcomes at a single point in time and does not permit causal or temporal inferences regarding the relationship between household sanitation and helminth infection. Finally, only a single stool specimen was collected and examined from each participant. As the excretion of helminth eggs may vary from day to day, reliance on a single specimen may have underestimated the true prevalence of helminth infections. Despite these limitations, the study provides important epidemiological evidence on the prevalence of helminth infections, household sanitation, and students' knowledge in Isiala Mbano Local Government Area and offers findings that can inform future research and public health interventions.

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