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PREVALENCE OF SOIL -TRANSMITTED PARASITIC INFECTION AND IT'S ASSOCIATION WITH ANTHROPOMETRIC STATUS AMONG SELECTED PRIMARY SCHOOL CHILDREN IN MINNA, NIGER STATE, NIGERIA

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ABSTRACT

Soil-transmitted helminth (STH) infections remain a major cause of morbidity among children in resource-limited settings. This cross-sectional study investigated STH prevalence and its association with anthropometric status among 514 primary school children aged 5-15 years in three selected schools in Minna, Niger State, Nigeria. Participants were selected by simple random sampling. Sociodemographic, risk-factor and anthropometric data (height, weight, age) were collected, and Z-scores (HAZ, WAZ, WHZ) computed using WHO growth standards. Stool samples were examined using the Kato-Katz technique for parasite identification and quantification, and Chi-square tests were used to assess associations. Overall STH prevalence was 8.4% (n=43), highest at Tudun Fulani Model School (9.3%). Roundworm was the most prevalent species (4.2%), followed by hookworm (2.5%), Schistosoma (1.2%) and whipworm (0.4%); most infections were light intensity (55.8%). Prevalence was higher among children aged 5-8 years and among females (9.7%) than males (7.1%). STH infection showed no significant association with age, gender, parental education, water source, barefoot walking, or vegetable-washing practices ($p>0.05$), but was significantly associated with parental occupation ($x2=7.198$, $p=0.0274$) and hand-washing practices ($x2=14.310$, $p=0.002$). Overall prevalence of underweight, stunting, wasting and overweight/obesity was 3.1%, 11.9%, 3.9% and 2.1%, respectively. Among infected children, stunting was most common (25.6%). Although STH infection was not significantly associated with HAZ, WAZ or WHZ classifications, infected children had significantly lower mean HAZ scores than uninfected children (-1.21 vs -0.05). These findings suggest STH infection may contribute to growth impairment, particularly stunting, underscoring the need for improved hygiene practices among school children.

Keywords: Prevalence, Soil-transmitted, Infections, Underweight, Overweight, Obesity.

Introduction

Soil-transmitted helminths are group of intestinal worms (helminths) whose life cycles are closely associated with the soil (Milgroom *et al.,* 2023). They are called "soil-transmitted" because their eggs or larvae develop and mature in contaminated soil before infecting humans (Santarém *et al.,* 2011). According to Hailegebriel *et al*. (2020) and Rahimi *et al*. (2023), these parasites disproportionately affect low-income communities with school age children being at higher risk of infection due to greater exposure to contaminated soil when they play, walk barefoot, eat soil, and do not practice good personal hygiene. These parasites primarily infect the gastrointestinal tract of humans and are a major public health concern, particularly in tropical and subtropical regions where poor sanitation and hygiene are common (Caldrer *et al.,*2022; Schlosser-Brandenburg *et al.,* 2023).

The common parasites causing intestinal infection are soil-transmitted helminths, *Ascaris lumbricoides* (ascaris lumbricoides), *Trichuris trichura* (whip worm), *Necator americanus* and *Ancylostoma duodenale* (hookworm) are the most prevalent and affect about one-sixth of the world population (Chelkeba *et al.,*2020). In addition to helminthic parasites, protozoa parasites such as *Giardia lamblia and Entamoeba histolytica* infections are very common in developing countries and most soil-transmitted helminths are among the most prevalent cause of human mortality.

Soil-transmitted helminthic infection caused by intestinal helminths and protozoans are among the most prevalent infections in developing countries carrying a high burden of morbidity and mortality (Chelkeba *et al.,* 2020). The burden of diseases associated with STP is huge. Approximately, 4.5 billion people are at risk, more than two billion people are affected worldwide, of whom 300 million suffer from associated severe morbidity. According to the World Health Organization report, there were 800 - 1000 million *Ascaris lumbricoides,* 700–900 million Hookworm infections, 500 million *Trichuris trichiura*, 200 million *Giardia lamblia*, and 500 million *Entamoeba histolytica* cases globally. Based on previous estimates, the Soil-transmitted helminths cause the annual loss of about 39 million disability-adjusted life years, which are responsible for vast health and financial problem. On the other hand, the most important drawback of Soil-transmitted helminths is around 90% of infected individuals remain in asymptomatic stages (Nwosu *et al.,* 2019).

Epidemiological studies carried out in different countries have shown that the socio-economic level of the society and environmental factors like hot and humid tropical climate plays a role in the increment of Soil-transmitted helminths prevalence (Ezeamama *et al.,* 2018)). In Sub-Saharan African (SSA) countries up to 250 million people are estimated to be infected with at least one or more species of Soil-transmitted helminths (WHO, 2002). Soil-transmitted helminths are highly prevalent in developing countries, including Nigeria, mainly related to poverty, poor personal hygiene, environmental sanitation, and overcrowding, low level of education and lack of safe drinking water (Asmare *et al.,* 2022). On the other hand, between one-quarter and one-third of the population in SSA countries is affected by one or more soil-transmitted helminth infections. Soil-transmitted helminths can cause vomiting, diarrhoea, anorexia, abdominal pain and nausea Soil-transmitted helminths associated with clinical disease are well documented. *Ascariasis* can result in often fatal intestinal obstruction; hookworm infection can cause iron deficiency anaemia*; trichuriasis* is associated with chronic dysentery and rectal prolapse. Amebiasis can result in dysentery and extra intestinal complications; *giardiasisis* associated with acute diarrhoea, steatorrhea and lactose intolerance. According to the World Health Organization (WHO), approximately 1.5 billion people are infected by soil-transmitted helminths (STHs) globally, with the highest prevalence reported from sub-Saharan Africa, South America, and Asia. Infections are caused

by 4 major species of nematodes, namely, the roundworm (*Ascaris lumbricoides*), the whipworm (*Trichuris trichiura*), the hookworms (*Ancylostoma duodenale and Necator americanus*), and the threadworm (*Strongyloides stercoralis*), often collectively referred to as geohelminths, (Aemiro *et al.,* 2024), moderate diarrhoea. (Amaha, 2025). This study aims to investigate the prevalence of soil-transmitted helminth (STH) infections and their association with the nutritional status of primary school children in selected primary schools in Minna, Niger State, Nigeria.

3.0 MATERIALS AND METHODS

3.1 Study Area

The study was carried out in Minna, capital of Niger state. The State was created on 3rd February 1976 from the former North Western State, and has 25 Local Government Areas, of which Minna, the state capital, comprises two Local Governments, Chanchaga and Bosso. Minna is a city in middle belt Nigeria and lies between latitude 9.5836^0 N and longitude 6.5463^0E at an altitude of 256m above sea level and has a land area of about $88Km^2$. The study was conducted in three primary school attending Tudun Fulani Model Primary School, Ibrahim memorial Primary School and IBB Primary School in Bosso and Chanchaga Local Government Area of Niger State.

Tudun Fulani Model Primary School:

Tudun Fulani Model Primary School is a public educational institution situated in the Tudun Fulani area of Bosso Local Government Area, Minna, Niger State, Nigeria. As part of the state's network of model primary schools, it serves the local community by providing foundational education to children.

Ibrahim Memorial Academy (IMAS)

Ibrahim Memorial Academy (IMAS): is a private educational institution located in Shanu, Minna, Niger State, Nigeria. The academy offers nursery, primary, and secondary education, aiming to provide quality learning experiences across all levels.

Ibrahim Badamasi Babangida (IBB) Primary School

Ibrahim Badamasi Babangida (IBB) is a public educational institution located in Minna, Niger State, Nigeria. Named after Nigeria's former military president, General Ibrahim Badamasi Babangida, the school serves as a foundational learning center for children in the region.

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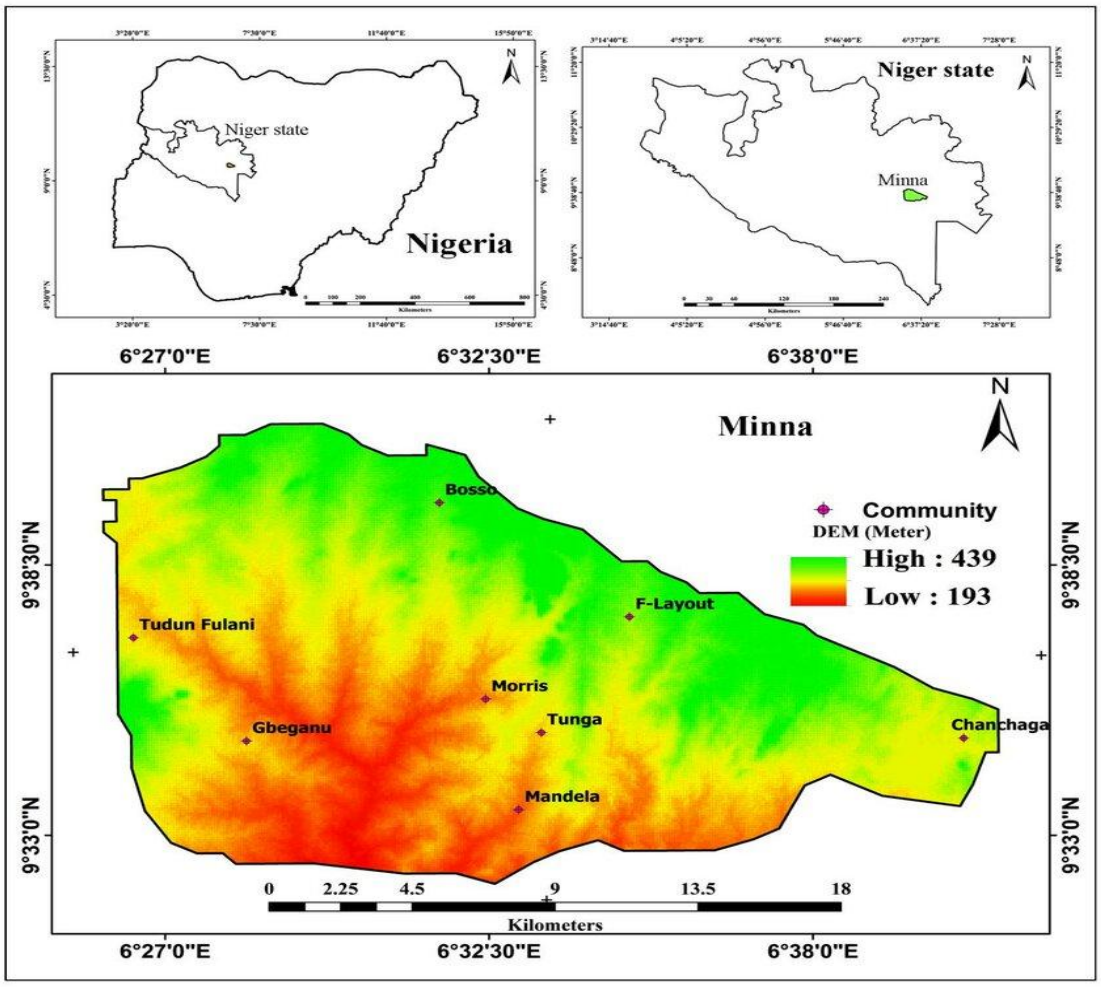


Figure 3.1: Map of study area (https://www.researchgate.net)

3.2 Study Design

A cross-sectional survey design was used. This means that data were collected at a single point in time to assess the prevalence of STHs and their association with the nutritional status of children.

3.3 Study Population

The study focused on primary school children aged 5–15 years attending Tudun Fulani Model Primary School, Ibrahim memorial Primary School and IBB Primary School in Minna. This age group is highly vulnerable to STPs due to increased exposure to contaminated soil and poor hygiene behaviours.

3.4 Sample Size Determination

The sample size was calculated using the Fisher's formula

$$n = \frac{z^2 pq}{d^2}$$

Where n = *sample size*

z = *critical value at 95% confidence level, usually set at 1.96*

P = *Prevalence* (74.2% was used) (Belete *et al.,* 2021)

$q = 1 - p$

$d = Precision, usually\ 5\%$

$n = \frac{Z^2 Pq}{d^2}$

$n = \frac{(1.96)^2(0.742)(0.0258)}{(0.0025)}$

$n = 294$

The sample size was increased to 514

3.5 Sample Collection

Permission was obtained from the headmasters in charge of the primary schools before the collection of samples. A labelled clean sample container was given to children and were encouraged to submit a stool sample in the following morning.

To ensure sample integrity, each child was instructed to seek the teacher's assistance to avoid contaminating the sample with urine or water. The samples were transported to the laboratory within 2 – 4 hours of collection to prevent egg degeneration, particularly of hookworm species, which are sensitive to prolonged exposure and temperature variations (Ochei, 2009).

3.6 Materials

The materials used for the collection and examination of stool samples in this study included essential tools for both field and laboratory work, specifically tailored for the Kato-Katz technique. For sample collection, clean screw-capped plastic containers, disposable spatulas, gloves, face masks, labelling materials, and cool boxes were employed to ensure hygienic and accurate handling. In the laboratory, microscopic glass slides, filter paper, forceps, wire gauze, cardboard paper cellophane tape, distilled water, glycerol and methylene blue solution were used to prepare a smear. Microscopic examination was carried out using a compound light microscope with ×10 and ×40 objectives, while a timer ensured consistent clearing time for accurate diagnosis. Disinfectants and proper waste disposal containers were also used to maintain laboratory hygiene and safety throughout the process. Kato-Katz technique was used to detect parasite.

3.7 Laboratory Analysis of Stool Samples

A piece of square shape cardboard paper was placed at the centre of the glass slide. 0.5 grams of screened stools sample was placed at the centre of cardboard paper until the hole at the canter of cardboard in filled, the cardboard paper was removed. The stool was covered with cellophane tape which was being socked in the mixture of 3% methalene blue, 100ml distilled water and 100ml of glycerol. The stool sample was spread using an applicator stick to minimise the thickness of the smear, the microscope glass slide was placed on the stage of microscope. The slide was viewed under low power of 10x objective lens in a system manner. The objective lens was switch to 40x to see the details of eggs; the eggs species was determined and counted (Ochei, 2009).

3.8 Anthropometric Measurements

Anthropometric measurements, including weight and height, were recorded using calibrated digital scales and stadiometers to calculate nutritional indices such as Body Mass Index-for-Age (BMI-for-age) and Height-for-Age (HAZ), based on WHO growth standards. Stool

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samples were collected and examined microscopically using the Kato-Katz technique to detect and quantify helminth eggs.

3.9 Data collection and Analysis

Data collection for this study involved both quantitative and qualitative approaches to obtain comprehensive information on soil-transmitted helminth (STH) infections and the nutritional status of selected primary school children in Minna, Niger State. Structured questionnaires were administered to gather demographic data, hygiene practices, sanitation access, and deworming history from participants or their guardians.

The data was analysed from the information extracted using statistical analysis.

Data were recorded systematically into datasheets and later entered into statistical software (e.g., SPSS or STATA) for analysis.

4.0 Results

A total of 514 school children participated in the present study, 204 (39.7%) from the Tudun Fulani model school, 146 (28.4%) from IBB primary school and 164 (31.9%) from Ibrahim memorial school. Out of the 514 school children surveyed, 266 (51.7%) were male and 248 (48.3%) were females,112 (21.6%) were in the age range of 5-8 years, 312 (60.8%) 9-12 years and 90 (17.6%) 13-16 years. All the school children (100%) resided in urban areas. The socio-demographic characteristics of school children attending selected schools during the period of this study are shown in Table 4.1.

Table 1: Socio Demographic (Gender, Age and Residence) of Children in Selected Primary School in Minna (n =514)

Characteristics	Frequency (n)	%
Schools		
Tudun Fulani model school	204	39.7
IBB Primary School	146	28.4
Ibrahim Memorial School	164	31.9
Gender		
Male	266	51.8
Female	248	48.2
Age group (Years)		
5-8	312	60.7
9-12	112	21.8
13-16	90	17.5
Residence		
Rural	0	0.0
Urban	514	100.0

4.1 Prevalence of Soil Transmitted Helminthic Infection in School Children

The prevalence of soil transmitted helminthic infection in school children is presented in Table 4.2. From the total of 514 school children, the prevalence of soil transmitted parasites was 43 (8.4%). Tudun Fulani model school 19 (9.3%) recorded the highest prevalence of soil transmitted parasites followed by Ibrahim memorial school 13 (7.9%) and IBB primary school 11 (7.5%).

Table 2: Prevalence of Soil Transmitted Helminthic Infection Among Primary School Children in Minna.

Schools	Number of Children	Number of Positive Cases	Prevalence (%)
Tudun Fulani Model School	204	19	9.3
Ibrahim Memorial School	164	13	7.9
IBB Primary School	146	11	7.5
Total	**514**	**43**	**8.4**

In this study, there is high prevalence an intensity of Ascaris worm among Tudun Fulani Model School 8 (3.3%), followed by IBB Primary School and Ibrahim Memorial School whose showed the same number an degrees of intensity among their Primary School children 7 (4.8%) respectively. The degree of intensity of Hook worm is higher among the children of the whole 3 primary schools selected in the study area than the Schistosome and whip worms. Hook worms 6 (2.9%) in Tudun Fulani 3 (2.1%) in IBB Primary School, 4 (2.4%) in Ibrahim Memorial School. Schistosome is 3 (1.5%) in Tudun Fulani, 1 (0.7%) in IBB Primary School and 2 (1.2 %) in Ibrahim Memorial School, whereby 2 (0.9%) of whip worm was recorded only from Tudun Fulani Model School. Meanwhile, the total numbers of the cases recorded in the study area was 43 (100%) with 53.5%, 30.2% and 16.3% light, moderate and heavy cases respectively. (Table 4.3).

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Table 3: Prevalence and Intensity of Soil Transmitted Helminthic among Primary School Children in Minna.

Schools	Helminths	No of cases (%)	Intensity (%)		
			Light	Moderate	Heavy
Tudun Fulani model school (n=204)	Ascaris worms	8 (3.9)	0 (0.0)	3 (37.5)	5 (62.5)
	Hookworms	6 (2.9)	4 (66.7)	2 (33.3)	0 (0.0)
	Schistosomes	3 (1.5)	3 (100.0)	0 (0.0)	0 (0.0)
	Whipworms	2 (0.9)	2 (100.0)	0 (0.0)	0 (0.0)
	Sub Total	19(9.3)	9(47.4)	5(26.3)	5(26.3)
IBB primary school (n=146)	Ascaris worms	7 (4.8)	3 (42.9)	3 (42.9)	1 (14.1)
	Hookworms	3 (2.1)	1 (33.3)	2 (66.7)	0 (0.0)
	Schistosome	1 (0.7)	1 (100.0)	0 (0.0)	0 (0.0)
	Sub Total	11(7.5)	5(45.5)	5(45.5)	1(9.1)
Ibrahim memorial school n=164	Ascaris worms	7 (4.3)	4 (57.1)	2 (28.6)	1 (14.3)
	Hookworm	4 (2.4)	3 (75.0)	1 (25.0)	0 (0.0)
	Schistosomes	2 (1.2)	2 (100.0)	0 (0.0)	0 (0.0)
	Sub Total	13(7.9)	9(69.2)	3(23.1)	1(7.7)
Total n=514	Ascaris worms	22 (4.2)	7 (31.8)	8 (36.4)	7 (31.8)
	Hookworms	13 (2.5)	8 (61.5)	5 (38.2)	0 (0.0)
	Schistosomes	6 (1.2)	6 (100.0)	0 (0.0)	0 (0.0)
	Whipworms	2 (0.4)	2 (100.0)	0 (0.0)	0 (0.0)
Total		**43(100%)**	**23 (53.5)**	**13 (30.2)**	**7 (16.3)**

Key: EPG Value
Light infection: 1-99
Moderate infection: 100-319
Heavy: 400 and above

The prevalence of soil transmitted helminthic in school children according to age is presented in Table 4.4. The highest prevalence of infection was recorded among children within the age group 5-8 years 26 (8.9%) followed by 9-12 years 10 (8.3%) and 13-16 years 7 (7.8%).

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Table 4: Prevalence of Soil Transmitted Helminthic among primary School Children in Minna by Age and Gender

	Tudun Fulani Model School N (%)	IBB Primary School N (%)	Ibrahim Memorial School N (%)	Total N (%)
Age Group (Years)				
5-8 years	11 (3.5)	8 (2.6)	7 (2.2)	26 (8.9)
9-12 years	6 (5.4)	3 (2.8)	1 (0.9)	10 (8.3)
13-16 years	2 (2.2)	0 (0.0)	5 (5.5)	7 (7.8)
Total	19 (9.3)	11 (7.5)	13 (7.9)	43 (8.4)
Gender				
Male	9 (8.9)	4 (5.3)	7 (10.0)	19 (7.1)
Female	10 (9.8)	7 (7.2)	6 (6.3)	24 (9.7)
Total	19 (9.3)	11 (7.5)	13 (7.9)	43 (8.4)

Higher prevalence of infection was observed among Females 24 (9.7%) compared to males 19 (7.1%).

Also, age group between 5 – 8 years shows high prevalence of 26 (8.3%) followed by female gender 24 (9.7%) an residence of urban area 48 (8.4%). Parent occupation also showed significant importance in this study, where people with both professional works like military personal, civil servant, Bricklayer and farmers showed 26 (6.6%), 5 (16.7%) and 12 (13.3%) positivity in this study. Generally, level of education always shows significant importance in the study of public health, and in this study people with non – formal education show high prevalence of STH 14 (20.0%) in this study. People with poor source of drinking water, non hygienic, and unprotected water supply, particularly public well water showed high prevalence of STH in this study 22 (8.0%). Lack of Personal hygiene, use of personal protective equipment, as well as food hygiene, environment sanitation, and well organized toilet facility played significant importance in prevalence of STH in the study area (Table 4.5).

Table 5: Factors Associated with Soil Transmitted Helminthic Infection Among School Children in minna

Variable	Response	Soil transmitted helminthic infection Status		χ2	P-value
		Number Positive (%)	Number Negative (%)		
Age group (years)	5-8(n=312)	26 (8.3)	286 (91.7)	0.8730	0.9573
	9-13 (n=112)	10 (8.9)	102 (91.1)		
	13-16 (n=90)	7 (7.8)	83 (92.2)		
Gender	Male (n=266)	19 (7.1)	247 (92.9)	1.0760	0.2997
	Female (n=248)	24 (9.7)	224 (90.3)		
Residence	Urban (n= 514)	43 (8.4)	471 (91.6)	-	-
	Rural (n = 0)	0 (0.0)	0 (0.0)		
Parent Occupation	Formal/Professional (n =394)	26 (6.6)	368 (93.4)	7.198	0.0274
	Skilled/Trades/Services (n = 30)	5 (16.7)	25 (83.3)		
	Agriculture (n= 90)	12 (13.3)	78 (86.7)		
Parent level of education	None (n=146)	29 (6.5)	415 (93.5)	14.310	0.0002
	A level (n=70)	14 (20.0)	56 (80.0)		
	O Level (n=444)	19 (12.0)	139 (87.9)		
Source of Water	Borehole (n=210)	15 (7.1)	195 (92.8)	5.7470	0.0565
	Tap (n=30)	6 (20.0)	24 (80.0)		
	Well (n=274)	22 (8.0)	252 (91.9)		
Working Bare footed	Yes (n=322)	19 (9.9)	173 (90.1)	0.9360	0.3333
	No (n=192)	24 (7.5)	298 (92.5)		
Carefully washing vegetables	Yes (n=290)	23 (7.9)	267 (92.1)	0.1641	0.6855
	No (n=224)	20 (8.9)	204 (91.1)		
Washing hands always	Yes (n=158)	11 (7.5)	135 (92.5)	4.188	0.1232
	No (n=210)	13 (6.2)	197 (93.8)		
Type of toilet used	Pit (n=433)	39 (9.0)	394 (90.9)	1.473	0.2248
	Water closet (n=81)	4 (4.9)	77 (95.1)		

Chi-square analysis revealed no statistically significant association ($p > 0.05$) between soil transmitted helminthic infection and age. There is a significant statistical association using chi-square when the P-value is less than or equal to 0.05 (5%) $P \leq 0.05$ while when $P > 0.05$ there is no significant association presents the mean Height-for-Age Z-scores (HAZ), Weight-for-Age Z-scores (WAZ) and BMI-for-age z-scores for children with and without soil-transmitted helminthic infection. There was no statistically significant association ($p = 0.8269$) between soil transmitted helminthic infection and HAZ scores (stunting). Children with soil-transmitted helminthic infection had a significantly lower mean HAZ (-1.210, SD = 0.82) compared to children without infection (-0.049, SD = 1.18). Similarly, no statistically significant difference ($p = 0.3753$) was observed between soil transmitted helminthic infection and WAZ scores (underweight). Children with Soil transmitted helminthic infection had a mean WAZ of -0.034 (SD = 0.79), and children without infection had a mean WAZ of -0.219 (SD = 0.81). Soil transmitted helminthic infection was also not statistically associated ($p = 0.1468$) with WAZ scores (Wasting). Comparison of Height-for-Age Z-Score (HAZ), Weight-for-Age Z-scores (WAZ) and BMI-for-age z-scores Between STH-infected and uninfected school children is presented in (Table 4.6).

Table 6: Relationship between Soil-Transmitted Helminthic Infections and Anthropometric Measures

Anthropometric measures	Soil transmitted helminthic infection	Mean (SD)	P value
Height-for-Age Z-Score	Positive	-1.210 (0.82)	0.8269
	Negative	-1.219 (1.02)	
Weight-for-Age Z-Score	Positive	-0.034 (0.79)	0.3753
	Negative	-0.219 (0.81)	
BMI-for-age z-scores	Positive	0.299 (1.04)	0.1468
	Negative	-0.049 (1.18)	

Key: SD: Standard deviation; BMI: Body Mass Index

The calculated WAZ, HAZ, and BAZ values for each child are presented in Figure 1,2,3,.

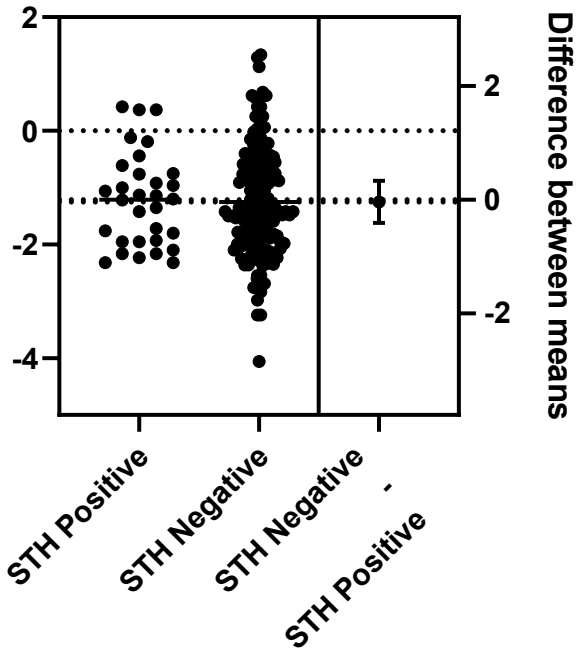


Figure 1: Comparison of Height-for-Age Z-Score (HAZ) Between STH-Infected and Uninfected Primary School Children in Minna

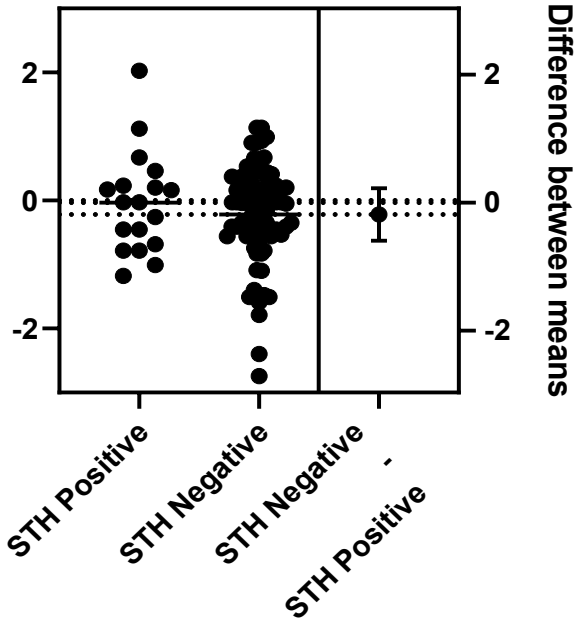


Figure 2: Comparison of Weight-for-Age Z-Score (WAZ) Between STH-Infected and Uninfected Primary School Children in Minna

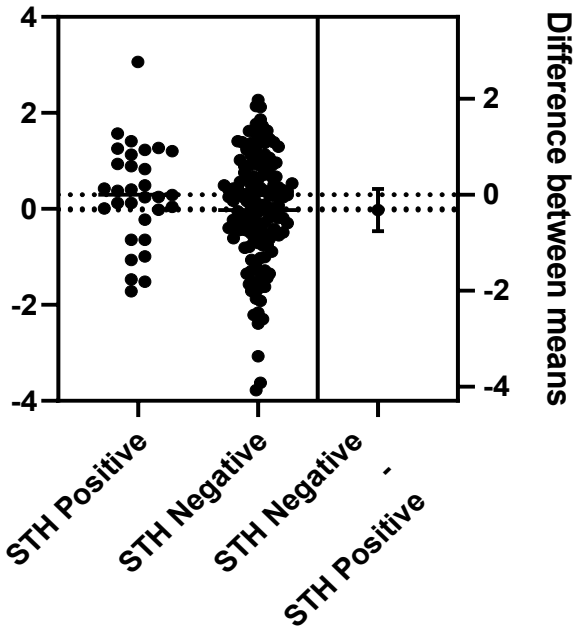


Figure 3: Comparison of BMI-for-Age Z-Score (BAZ) Between STH-Infected and Uninfected Primary School Children in Minna

4.2 Discussion

This study investigated the prevalence of soil-transmitted helminth (STH) infections and their association with the nutritional status of primary school children in selected primary schools in Minna, Niger State. A total of 514pupils participated in the study, the total prevalence of soil-transmitted helminth (STH) infections among the study population was 43 (8.4%), indicating a moderate level of endemicity based on WHO classification. Among the schools surveyed, Tudun Fulani model school 19 (9.3%) recorded the highest prevalence of soil transmitted parasites followed by Ibrahim memorial school 13 (7.9%) and IBB primary school 11 (7.5%). These findings confirm that STH infections remain a public health concern among primary school children in Nigeria. Soil-transmitted helminthic infections have significant health, social, and educational impacts on children including nutritional impairment, gastrointestinal disorders. cognitive and educational impact and increased susceptibility to other infections due to weakened immune system (Pabalan *et al.*, 2018; Ekeleme *et al.*, 2025).

The observed prevalence of soil-transmitted helminth (STH) infections in this study (8.4%) was lower than the prevalence rates reported in several other parts of Nigeria. In Ogun State, Idowu *et al.* (2022) reported a significantly higher prevalence of 69.8% among children under 2 years. Yaji *et al.* (2023) recorded an STH prevalence of 28.1% among school children in Benue State. Prevalence of 30.3% was reported among primary school children by Odinaka *et al.* (2015) in Imo State while Usang *et al.* (2025) found a prevalence of 28.8% among children in Calabar, Cross river. The differences in reported prevalence of soil-transmitted helminth (STH) infections can be attributed to variations in sample size, detection techniques, and study locations. Age group differences also play a significant role, as younger children are generally more susceptible to STH infections due to their frequent exposure to contaminated environments and underdeveloped immune systems, as noted by Idowu *et al.* (2022). Additionally, higher prevalence rates in some regions may result from disparities in

environmental conditions, hygiene practices, population density, socioeconomic status, and the effectiveness of deworming programs among school children.

In Nigeria, soil-transmitted helminths (STH) continue to be prevalent among vulnerable populations, especially children, who are at greater risk due to their frequent exposure to contaminated environments (Karshima *et al.*, 2018; Ohuche *et al.*, 2020; Usang *et al.*, 2025). Consistent with existing reports from other part of Nigeria, ascaris lumbricoides 22 (4.2%) were the most prevalent soil-transmitted helminths followed by hookworms 13 (2.5%), schistosomes6 (1.2%) and Whipworms 2 (0.4%), these results show the ongoing burden of STH infections in the study area. The predominance of roundworm aligns with its faecal-oral mode of transmission and the persistence of poor hygiene practices in the study area. Similar findings have been reported by Ojorungbe *et al.* (2014) and Idowu *et al.* (2023). Studies have demonstrated an inverse relationship between socio-economic status and prevalence of (Ojurongbe *et al.*, 2014). Low socio-economic status as well as poor hygiene practices demonstrated by majority of the participants in this study could explain why significantly high proportion of the respondents were infected with ascaris lumbricoides and hookworm. The relatively elevated prevalence of ascaris lumbricoides noted in this study could be attributed to the resilience of its eggs under diverse environmental conditions, and the adhesive properties of their shells, which facilitate attachment to human hands, fruits, and vegetables (Aemiro *et al.*, 2024).

The intensity of Soil-transmitted helminths refers to the quantity or load of helminthic worms or eggs present in an individual or population (Montresor *et al.*, 2015). It is often measured by the number of parasite eggs per gram of stool (EPG) or by the number of worms present in a host (Cepon-Robins *et al.*, 2014; Khurana *et al.*, 2021). Intensity is used to describe the severity of an infection and is typically categorized as light, moderate, or heavy based on the number of parasites detected (Eyayu *et al.*, 2022).

In terms of intensity, most infections were classified as light 23 (53.5%), while moderate and heavy infections constituted13 (30.2%) and 7 (16.3%) respectively. The presence of moderate and heavy infections, albeit in a minority, show the public health significance and the potential risk for complications if untreated. In epidemiological studies, intensity helps assess the burden of infection and the potential for associated health impacts, including nutritional deficiencies, growth retardation, or anaemia in affected populations (Pullan *et al.*, 2014; Masangcay *et al.*, 2021). This is particularly important in the context of children, as higher intensity infections can lead to more severe health consequences.

Heavy infections in the present study were exclusively observed in cases of roundworm (*Ascaris lumbricoides*), raising concerns about their potential impact on affected children, including impaired nutrient absorption and intestinal obstruction. These complications can significantly affect the health and development of children. Furthermore, Albonico *et al.* (2002) noted that intestinal helminth infections are particularly prevalent among school-age children, often occurring with high intensity. This makes them a critical group for study, as they are not only more susceptible to such infections but also play a central role in contaminating the environment and transmitting these parasites. The high intensity of infection in this age group highlights the importance of controlling soil-transmitted helminths to prevent further transmission and mitigate the associated health risks.

Sociodemographic factors are characteristics of a population that influence health outcomes, including the prevalence of infections (Ghanem *et al.*, 2023; Aremu *et al.*, 2025). In the present study, children within the age group 5-8 years 26 (8.9%) recorded the highest prevalence of soil parasites. Tudun Fulani model school recorded prevalence of 6 (5.4%), 11

(3.5%), and 2 (2.2%) in the age group 5-8 years, 9-12 years and 13-16 years respectively. IBB primary school recorded 3 (2.8%), 8 (2.6%) and 0 (0.0%) while Ibrahim memorial school recorded 1 (0.9%), 7 (2.2) and 5 (5.5%).

With children aged 5-8 years exhibiting the highest infection rate (8.9%), this finding could be related to the improper personal hygiene among younger children, as children within this age group play with soil making them more susceptible to the infection. Study byTchakounté *et al.* (2018) and Usip *et al.* (2023) recorded higher STH prevalence among younger population. Usip*et al.* (2023) reported higher prevalence of infection among the younger children in the playgroup while Tchakounté *et al.* (2018) reported higher prevalence (2.5%) of STH in children in the age group between 1-10 years while higher age groups 11-20 years recorded 0.5%. This is a reflection of the exposure patterns in view of the fact that younger children are active, adventurous and mindless of hygienic habits. The dropping of infection rate in the higher age group may be attributed to awareness, cleanliness, good sanitary habit and the development of protective immunity earlier in life due to repeated exposure from infancy. However, Ojurongbe *et al.* (2014) reported no significant difference between age and prevalence of STH among primary school children.

Gender is an important sociodemographic factor that can influence the prevalence of soil-transmitted helminths (STH) infections in various populations biological differences between males and females, coupled with distinct behavioural patterns, social roles, and hygiene practices, often result in gender-based variations in exposure and susceptibility to STH infections (Dias *et al.*, 2022; Moon, 2024).

In the present study, Females 24 (9.7%) recorded higher prevalence of soil transmitted parasites compared to males 19 (7.1%). This suggests that both male and female children are at risk of soil-transmitted helminthic infections in the studied population. However, when the data is examined by individual schools, slight variations in prevalence between genders become evident.

In Tudun Fulani Model School, the prevalence of Soil-transmitted helminths was marginally higher in females (9.8%) than in males (8.9%). This slight difference suggests that female students in this school may have slightly higher exposure or susceptibility to helminthic infections, although the difference is minimal. At IBB Primary School, the trend continued, with females (7.2%) showing a higher prevalence than males (5.3%). This again showed a higher burden of helminthic infections among female pupils in this school, which could be influenced by behavioural, environmental, or hygiene-related factors. In contrast, the pattern is reversed in Ibrahim Memorial School, with a higher prevalence of Soil-transmitted helminths among males (10.0%) compared to females (6.3%). This gender difference in prevalence suggests that in this school, male students may be more exposed to conditions that increase their risk of infection, such as playing in contaminated environments or inadequate hygiene practices (Pasaribu *et al.*, 2019; Riaz *et al.*, 2020). These gender-related variations across schools suggest that local factors, including environmental conditions, personal hygiene practices, and awareness of helminthic infections, may influence the prevalence of Soil-transmitted helminths among children.

Findings contrary to those recorded in this study were reported by Riaz *et al.* (2020) who reported that STH infection rate was higher in males compared to females, this was attributed to the suppression of immune system and the stimulatory effect of estrogen on immune response against GIT.Tchakounté *et al.* (2018) also reported that female participants (2.5%) were slightly more infected compared to male participants (2%). Odinaka *et al.* (2015), Usip *et al.*, (2023), Imalele *et al.* (2023) also recorded a similar trend in their study.

It is worth noting that in the present study, gender-based differences in STH prevalence were observed, with higher prevalence among females in public schools (Tudun Fulani Model School and IBB Primary School), while male students recorded higher prevalence in the private school (Ibrahim Memorial School). This pattern may reflect differences in school environments, hygiene practices, and access to health education between public and private schools. Public schools may have larger class sizes, less strict hygiene regulations, and limited access to sanitation facilities, potentially increasing female students' exposure to contaminated environments while male students in the private school may have higher exposure due to more frequent outdoor activities or differing hygiene behaviours. Amoran *et al.* (2017) and Nwadiuto *et al.* (2022) noted that public schools may have less funding and poorer hygiene facilities compared to private schools, increasing the risk of exposure to parasites and private schools may enforce better hygiene practices and provide health education.

Relationship between sociodemographic factors and soil-transmitted helminthic infections (STH) is essential for identifying at-risk populations. In determining the factor associated with soil transmitted helminthic infection, there were no statistically significant association ($p > 0.05$) between soil transmitted helminthic infection and age ($\chi2= 0.8730$, $p = 0.9573$), gender ($\chi2 = 1.0760$, $p = 0.2997$),parent education level ($\chi2= 14.310$, $p = 0.0002$) ,Source of Water ($\chi2 = 5.7470$, $p = 0.0565$), walking bare footed ($\chi2 = 0.9360$, $p = 0.3333$), carefully washing vegetables ($\chi2 = 0.1641$, $p = 0.6855$) and type of toilet used ($\chi2 = 1.483$, $p = 0.2248$). This lack of significant association suggests that these factors may not independently influence the prevalence of soil-transmitted helminthic infections among the school children in this study. These findings suggest a generalized exposure pattern within the urban population studied and may indicate limitations in current hygiene and sanitation interventions. Similarly, Usang *et al.* (2025) reported no association between these variables and the prevalence of STH, however contrary findings were reported by Kattula *et al.* (2014), Pasaribu *et al.* (2019) and Tekalign *et al.* (2019) who noted significant association between most of these variables and the prevalence of soil transmitted helminths. These variations could be attributed to differences in socio-cultural behaviour and environmental factors.

However, a statistically significant association ($p < 0.05$) was found between parent's occupation ($\chi2 = 7.198$, $p = 0.0274$), washing hands always ($\chi2 = 4.188$, $p = 0.1232$), and soil transmitted helminthic infection, suggesting that these factors are an important determinant of infection risk among the school children. This could be due to the influence of parental socioeconomic status on hygiene practices and access to sanitary facilities, as well as the protective effect of regular handwashing in preventing faecal-oral transmission of parasites (Chuda and Fauziah *et al.*, 2022).

The mean HAZ for children with soil-transmitted helminthic infections was significantly lower (-1.210, SD = 0.82) than for uninfected children (-0.049, SD = 1.18), indicating that infected children were generally shorter for their age compared to their uninfected peers. Despite this noticeable difference in HAZ scores, the association between soil-transmitted helminthic infections and stunting (HAZ scores) was not statistically significant ($p = 0.8269$). This result suggests that while soil-transmitted helminthic-infected children tend to have lower HAZ scores (indicating higher stunting prevalence), the difference is not strong enough to be considered statistically significant in this study. The lower HAZ among infected children may be attributed to the chronic impact of helminthic infections on nutrient absorption, which can impede linear growth. Chronic inflammation caused by these infections may also interfere with growth hormones, leading to stunted growth.

The mean WAZ for infected children was -0.034 (SD = 0.79), while uninfected children had a slightly lower mean WAZ of -0.219 (SD = 0.81). The absence of a statistically significant association (p = 0.3753) between soil-transmitted helminthic infections and WAZ indicates that infection status did not have a substantial effect on underweight prevalence among the study population. This finding aligns with the understanding that while soil-transmitted helminthic infections can contribute to weight loss due to reduced nutrient absorption, their direct impact on body weight may be less pronounced than on height. The short-term effect of soil-transmitted helminthic infections is more likely to be reflected in wasting (low BMI) rather than underweight (low WAZ), which is a longer-term measure of nutritional status.

The analysis also found no statistically significant association (p = 0.1468) between soil-transmitted helminthic infections and BMI-for-Age Z-scores, a measure of wasting. The mean BAZ for parasite infected children did not differ significantly from that of uninfected children, suggesting that the presence of soil transmitted helminthic infections may not directly impact the risk of wasting (acute malnutrition). This result is consistent with the fact that wasting is more immediately influenced by acute factors such as sudden food shortages or severe infections, rather than chronic conditions like soil-transmitted helminthic infections.

The lack of statistically significant associations between soil-transmitted helminthic infections and the three nutritional indicators (HAZ, WAZ, and BAZ) could be attributed to the sample size of the study. The relatively small sample size of soil-transmitted parasite infected children (43) may limit the statistical power to detect significant differences. In addition, mild infection levels, nutritional interventions and confounding factors including socioeconomic status, dietary diversity, and access to healthcare may also play a role in in the observed nutritional outcomes, masking the direct impact of soil-transmitted helminthic infections.

5.0 Conclusion

Soil – transmitted helminths (STHs) are among the most common infections worldwide and affect the poorest and most deprived communities. The primary STHs affecting humans are *Ascaris lumbricoides (roundworm), Trichuris trichiura (whipworm),* and hookworms (*Ancylostoma duodenale and Necator americanus*) (WHO, 2020). These parasites are transmitted through contact with contaminated soil, typically via ingestion of eggs or skin penetration by larvae.

Soil –transmitted helminths infections are classified as neglected tropical diseases 9(NTDs)and are prevalent in areas with poor sanitation, lack of clean water, and inadequate hygiene practices Globally, it is estimated that over 1.5 billion people are infected with STHs, with significant proportion being school- aged children (WHO,2020) Sud-Saharan Africa bears a substantial burden of STHs due to climatic conditions conducive to helminth survival and persistent socioeconomic challenges In Nigeria, several studies have reported high prevalence rates of STHs among children. For instance, found 35.6% prevalence among children in rural communities. Similarly recorded a prevalence of 41.3%in South-eastern Nigeria. The endemicity of these infections in Northern regions like Niger State is associated with open defecation, poor sanitation, and low awareness of hygiene practices, Several risk factors contribute to the high prevalence of soil-transmitted helminths infections among children, particularly in low – resource setting like Nigeria. Key among these are poor sanitation, lack of access to clean water, open defecation, and inadequate hygiene practices such as not washing hands after defecation or before eating (WHO, 2024) Environmental factors, including the presence of contaminated soil around schools and homes, also play a crucial role in sustaining the transmission cycle. Behavioural habit common among children

such as walking barefoot, playing in dirt, and consuming unwashed fruits further increase their exposure to infective helminth eggs or larvae. Socioeconomic status and parental education levels have been strong linked to infection risk, as children from lower – income households with less educated caregivers are more likely to live in environments with poor sanitary infrastructure. In Minna, Niger State, this recent study highlighted that children attending schools without proper toilet facilities or access to handwashing stations were significant more likely to be infected. Addressing these risk factors through health education, improved sanitation, and regular deworming is critical for reducing the burden of STH among school – aged populations.

Soil – transmitted helminth (STH) infections significantly impair the growth and nutritional status of children, particularly in endemic region. Chronic infections with parasites such as *Ascaris lumbricoides, Trichuris trichura,* and hookworms interfere with nutrient absorption, cause gastrointestinal blood loss, and trigger inflammatory responses that contribute to malnutrition, stunting, and wasting. Hookworm infections, for example, are a leading cause of iron – deficiency anaemia, especially in school – aged children, due to blood loss in the intestinal tract. Studies in Nigeria have demonstrated strong associations between STH infections and poor anthropometric indices. For instance, many report shows that infected children in Lagos were significantly more likely to be stunted and underweight than their uninfected peers. Similar observation in this study show that children with helminth infections had lower mean weight – for – age and height-for- age scores, indicating both acute and chronic nutritional deficiencies. Beyond physical health, these effects have broader implications on cognitive development, school performance, and future productivity. Therefore, controlling STH infections is not only essential for reducing disease burden but also for improving childhood nutrition, educational attainment, and long – term human capital development.

Anthropometric indicators are crucial tools for assessing the health, nutritional status, and physical development of children. The most commonly used anthropometric measurements include height-for-age (underweight), and weight-for-height or body mass index-for-age (wasting), all of which serve as proxies for chronic or acute undernutrition. These indicators provide insight into growth patterns and can highlight the impact of infections, dietary deficiencies, and socioeconomic factor on child health. According to UNICEF (2023), stunting is a sign of long-term nutritional deprivation, while wasting indicates recent and serve weight loss, often due to acute illness or insufficient food intake. In region where soil – transmitted helminths (STH) infections are prevalent, anthropometric deficits are more pronounced. Studies in Nigeria have shown that children infected with helminth are significantly more likely to be stunted or underweight, largely due to nutrient malabsorption and chronic inflammation. Monitoring these indicators in school – aged populations is critical for early identification of at-risk children and for guiding nutritional interventions, public health policies, and school health programs aimed at improving child survival and development outcomes.

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Authors Contribution

The authors confirm their contribution to the paper as follows: that the research contributed empirical evidence on how soil-transmitted helminth infections affect children's anthropometric indices such as:

- Height-for-age
- Weight-for-age
- Body Mass Index (BMI)
- Mid-upper arm circumference

Declaration of Conflicting interest

The authors declared no any conflict with respect to this research

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