



High Prevalence of Helminthiasis in Some Selected Schools in Zaria Local Government Area of Kaduna State; the Need for an Effective Control Measure

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ABSTRACT

This study aimed to examine the prevalence of helminth infections in primary school children in Zaria Local Government Area of Kaduna State. Stool samples were collected from 245 pupils and analyzed using the Kato-Katz technique. A total of 256 (64.0%) were positive for helminth infections with Hookworms having the highest rate of prevalence at 52.3%. The prevalence rate of helminth parasites was high in all schools with LGEA Ahmad Gyellesu having the highest (100%), followed by LGEA Baba Ahmad (60%), UBE Isa Nabawa (46%) and UBE Angwan Kaya (50%). Stool samples of pupils in primary 1 to 5 were randomly selected and the results show that there was a high prevalence rate in Primary 5 pupils (20.0%) while Primary 2 pupils had the least (10.0%). The prevalence of helminth infections was higher among males (51.3%) than females (28.4%) ($p = 0.000$). Overall helminth infections were higher in the 8–9 year age group (75%) than in the other age groups ($p = 0.064$) Hookworm and Hymenolepis eggs co-infection (3%) was the most common mixed infection and were significantly higher in males than females. The total prevalence rate (64%) in this study was above the stipulated range (12.5–50.2% for soil-transmitted helminthiasis), as reported by the Nigerian Federal Ministry of Health. Holistic control measures must be enforced by the Kaduna State Government to reduce the prevalence rate of helminth infections among school children within the state.

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INTRODUCTION

The parasitic illnesses known as soil-transmitted helminthiasis are spread to people by nematode worms in feces-contaminated soil. These are some of the diseases that are most prevalent among residents of Sub-Saharan African nations. The most current estimates indicate that these parasites are present in more than 2 billion people (WHO,

2022). In places with poor sanitation and unsafe water supplies, the prevalence is greatest (WHO, 2022).

The main soil-transmitted helminths (STHs) of worry to humans are *Ascaris lumbricoides*, *Trichuris trichiura*, *Necator americanus*, and *Ancylostomaduodenale*. According to reports, in 2010 an estimated 819.0 million individuals had *A. lumbricoides*,

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438.9 million had hookworm, and 464.6 million had *T. trichiura* infections (WHO, 2022; CDC STH, 2022). STH light infections typically don't cause any signs. However, more serious illnesses cause a range of signs and symptoms, including malnutrition, nutrient malabsorption, cramping, fatigue, and slowed cognitive and physical growth. Worms deplete protein and iron levels by feeding on host cells and blood (WHO, 2022; CDC STH, 2022). Additionally, some helminths that are spread by soil can make people lose their appetite, which lowers their intake of nutrients and their level of physical fitness. It has been demonstrated that nutritional deficiencies brought on by helminths in the soil have a significant effect on growth and physical development (WHO, 2021; UNICEF, 2021). The prevalence of soil-transmitted helminth infection is high in tropical and subtropical nations with poor sanitary infrastructure, inefficient waste management systems, a dearth of safe water supply, and low socioeconomic standing.

In addition, estimates indicate that *Taenia* species or *Hymenolepis nana* infections affect 95 to 135 million individuals worldwide. To ensure that the WHO helminth control goals are met, the efficacy of the ongoing deworming program for the control of helminth must be verified, and if necessary, adjustments to the strategy must be made. An update on the condition of helminth infection and associated morbidities, like anemia, malnutrition, and subpar scholastic performance in children, is required. Furthermore, conflicting study results have been found regarding the links between helminth infections and

anemia, malnutrition, and subpar academic performance. While some studies discovered that children with helminth infections had a higher chance of anemia, undernutrition, and poor academic performance (WHO, 2021; UNICEF, 2021; DiPasquale, 2020), others have not discovered any connection between helminth infection and anemia, malnutrition, or subpar academic achievement. Even some studies discovered that kids who had helminth infections from soil had a reduced risk of anemia and malnutrition (Moola et al., 2021).

This research sought to determine the prevalence of helminth infections among primary school students in Kaduna State's Zaria Local Government Area. Ethical approval was obtained from the Kaduna State Health Research Ethics Committee, and the study protocol was approved by the Education Secretary of Zaria Local Government Area of Kaduna State.

MATERIALS AND METHODS

The study was conducted in the city of Zaria Local Government Area of Kaduna State, Northwest Nigeria. The research design used for the study was a cross-sectional study design among children of four public primary schools in Zaria Local Government of Kaduna State. These schools are; LGEA Ahmadu Gyellesu, LGEA Baba Ahmed, UBE Isa Nabawa and UBE Angwan Kaya

The study's participants were chosen students from municipal elementary schools. The subjects' eligibility was established after they gave a stool sample, the child's assent, and parental consent. The research

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lasted three months (October to December 2022).

Failure to provide a stool sample, history or physical examination results consistent with the presence of severe chronic diseases like active tuberculosis and developmental disability, as well as children attending privately owned primary schools in Zaria, were excluded from this research.

The selection of a primary school in the Zaria Local Government was done using a streamlined random sampling method. Twenty students from each primary one to five class from the four chosen institutions were chosen through systematic random sampling. The chosen kids' stool samples were obtained in pre-labeled sampling bottles, and they were tested using the formol-ether concentration method (Samuel et al., 2017).

All stool specimens were macroscopically examined for color, consistency, blood, mucous, pus, and parasite stages visible to unaided eyes, such as adult helminths, larvae, and segments of cestodes. They were then examined with a light microscope and the formol-ether concentration method using a direct smear. A drop of emulsified stool sample was placed on both ends of the slide for the direct smear method, and a drop of Lugol's iodine was added to one stool drop while leaving the other drop unstained. Smears were examined under an optical microscope at 100x and then 400x magnification to detect and identify protozoan and helminth diagnostic stages (Cheesbrough, 2009). Because the formol-ether concentration method is the gold standard for examining IPIs, it was used as previously described (Cheesbrough, 2009). It was made by

emulsifying 1 gram of stool in 8 mL of 10% formalin and filtering it into another tube before adding 4 mL of diethyl ether to the filtrate. After homogeneously mixing for 1 minute, the mixture was centrifuged at 3000 rpm for 1 minute to remove the supernatant. Finally, a small amount of sediment was examined under a microscope. To detect ova, cysts, trophozoites, and larvae of enteric parasites, well-trained parasitologists examined at least two smears from each stool specimen. Similar to the direct smear, magnifications of 100x and 400x were used, with Lugol's iodine solution added to smears to facilitate identification of cysts of intestinal protozoan parasites (Abou El-Naga, 2014).

A total of four hundred stool samples of children (5- 9 years) from Primary 1 to 5 whose parents and head teachers consented were randomly collected from the four primary schools.

Parasites' burden was determined by examination of stool samples from each study participant. Stool samples were taken to the Helminthology Laboratory of the Department of Veterinary Parasitology and Entomology, Ahmadu Bello University Zaria for analysis.

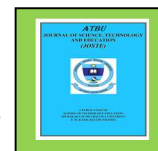
The data collected were analyzed using the Statistical Package for the Social Sciences Version 21.0. Descriptive (frequency and tables) and inferential statistics were used appropriately with a 99% confidence limit ($P < 0.01$).

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RESULTS AND DISCUSSIONS

Prevalence of Helminth Infections in Stool Samples of School Children in Zaria

In this study, the rate of transmission of soil helminth infections in school children in Zaria Local Government was considerable high. Out of 400 stool samples examined, 256 (64%) were found to be infected. Eight soil helminthic parasites were detected, including nematodes, cestodes, and protozoans but trematodes were not found in the study. The prevalence rate of helminth parasites was high in all schools with LGEA Ahmad Gyellesu having the highest (100%), followed by LGEA Baba Ahmad (60%), UBE Isa Nabawa (46%) and UBE Angwan Kaya (50%). Hookworm parasite was found to have the highest prevalence rate across the schools sampled with 52.3%, while *Enterobiusvermicularis* (2.3%) and *Taeniaspecies* (0.8%) were recorded as low in this study. Mixed infections were observed in all the primary schools sampled. There was a significant difference in the prevalence of helminth infections among the schools sampled for this study. ($\chi^2= 139.924$, $P= 0.000$) (Table 1). The overall prevalence of soil-transmitted helminthiasis in Schools in Zaria Local Government Area of Kaduna State was (64%) above the stipulated range (12.5–50.2% for soil-transmitted helminthiasis) as previously reported by the Nigerian Federal Ministry of Health (Federal Ministry of Health, 2015). The result of this study was similar to the findings of Aberaet *al.* (2013) in northwest Ethiopia with a prevalence case of 51.5% of intestinal parasites among primary school children. Houmsouet *al.* (2010) reported 58.5% in Makurdi Benue State.

In Oyo and Ogun states; Agboladeet *al.* (2007) and Salawuet *al.* (2014) found a high prevalence of cases of 66.2% and 62.2% among school-age children respectively. The high prevalence rate of soil-transmitted helminth infections may be attributed to a lack of regular deworming procedures, improper management of the dumping sites near the schools, insufficient water supplies, poor drainage systems, undernutrition, poor personal hygiene, inadequate footwear, cultural beliefs, and a dearth of toilet facilities.

Hookworm was the most prevalent among the soil-transmitted helminths (56.2%). According to mapping results from the Ogoja Local Government Area in 2014, hookworm (11.51%) was the most common soil-transmitted helminth. Habits such as not wearing shoes frequently might contribute to hookworm infection (Alelignet *al.*, 2015). Some of the children who were chosen for the study displayed this attitude, and this, combined with the fact that the pupils utilized some of the schools' surrounding areas as toilets, exposed them to hookworm infestation. Agrarian communities have been linked to higher rates of Hookworm infection, according to reports (Ukibeet *al.*, 2018). Similarly, Alelignet *al.* (2015) found that in Ethiopian school children, the prevalence of hookworm infection was significantly higher than that of other soil-transmitted helminth infections. This finding was attributed to the fact that the majority of the children in the study walked barefoot over loamy soils and cultivated fields. Hookworm having the highest prevalence corresponded with the findings made by Njobaet *al.* (2022) in Makurdi, Benue

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State. Since hookworm eggs hatch and quickly penetrate the skin of the host during the rainy season, hookworm infection transmission is very seasonal. The prevalence was further boosted by

the children's rate of exposure to risk factors, such as walking barefoot to fields or schools, and the favorable climatic circumstances for the development of the infective stage.

Table 1: Prevalence of *Helminth* Infections in Stool Samples of School Children in Zaria Local Govt.

School	No Examined	No Infected (%)	HK (%)	TT (%)	SS (%)	HY (%)	EV (%)	IS (%)	AS (%)	TA (%)	MI (%)	P-value
LGEA AG	100	100 (100.0)	50 (50.0)	20 (20.0)	25 (25.0)	2 (2.0)	1 (1.0)	0 (0.0)	0 (0.0)	1 (1.0)	1 (1.0)	*0.000
LGEA BA	100	60 (60.0)	30 (50.0)	10 (16.7)	4 (6.7)	3 (5.0)	5 (8.3)	3 (5.0)	5 (8.3)	0 (0.0)	0 (0.0)	
UBEIN	100	46 (46.0)	26 (56.5)	15 (32.6)	1 (2.2)	1 (2.2)	0 (0.0)	0 (0.0)	1 (2.2)	1 (2.2)	1 (2.2)	
UBEAK	100	50 (50.0)	28 (56.0)	15 (30.0)	0 (0.0)	4 (8.0)	0 (0.0)	1 (2.0)	1 (2.0)	0 (0.0)	1 (2.0)	
Total	400	256 (64.0)	134 (52.3)	60 (23.4)	30 (11.7)	10 (3.9)	6 (2.3)	4 (1.6)	7 (2.7)	2 (0.8)	3 (1.2)	

Keys: HK- Hookworm, TT- *Trichuistrichiura*, SS- *Strongyloidesstecoralis*, HY- *Hymenolepis* eggs, EV- *Enterobiusvermicularis*, IS- Isospora species, AS-*Ascarislumbricoides*, TA- *Taenia* eggs, MI- Mixed Infection, LGEAAG-LGEA Ahmad Cyellesu, LGEA BA-LGEA Baba Ahmad, UBEIN-UBE Isa Nabawa, UBEAG- UBE Angwan Kaya
 *Significant P-value

Prevalence of Helminth Infections in Relation to Class of Pupils

In this study, stool samples of children in Classes 1 to 5 were collected. Children in primary 5 were observed to be the most infected 80 with the highest rate of prevalence of 20% and Primary 4 with 50 infected and a prevalence rate of 12.5%. In terms of helminthic parasites prevalence among the classes, Hookworm parasites (52.3%) was the most prevalent among helminthic infections while a low prevalence rate was recorded with *Enterobiusvermicularis* (2.3%) and *Taenia Species* (2%) respectively. ($\chi^2= 20.406$, $P= 0.00$) (Table 2). Most pupils in Class 1 fall between the age ranges of 5 to 7 years old and are the most vulnerable to infections, because of their developing

immune systems. (Ygberget *al.*, 2011). Early childhood is a time of immune system development and underdevelopment. Breastfeeding is frequently continued until the child is two years old, which offers crucial early protection through passive IgG antibody transmission. Food neophobia and fussiness/picky eating, two food-related nondirective feeding habits in toddlers to preschoolers, result in a restricted, poor diet that has an impact on their weight and nutritional status (Wood *et al.*, 2020). Due to their growing sensory systems, which include touch awareness and taste, they are more likely to put things in their mouths, increasing their risk of developing parasite infections (White *et al.*, 2013).

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Another factor that may be responsible for the high prevalence of helminth infections is under nutrition. Under nutrition occurs when a person's diet is deficient in both calories and nutrients. A person is said to be "wasting" if they have a low weight-for-height ratio for their age. Stunting refers to a low height-for-age value, whereas underweight refers to a low weight-for-age value. The World Health Organization (WHO) growth standard is frequently used to characterize children who show signs of wasting, stunting, or underweight and report values that are more than two standard deviations below the population standard. (WHO, 2021). There are two types of malnutrition: acute and chronic. Inadequate food intake is the primary cause of acute under nutrition in children. Secondary acute malnutrition results from abnormal nutrient loss, increased energy expenditure, or decreased food intake. This condition is usually associated with underlying

chronic conditions such as pediatric cancers or congenital heart disease, persistent infections, chronic liver disease, cystic fibrosis, chronic renal failure, and neuromuscular disorders.

Wasting is the main sign of acute under nutrition (WHO, 2020). Contrarily, chronic under nutrition is brought on by a deficiency in particular nutrients at particular developmental stages in early childhood, which inhibits both physical and mental development. The most common sign of chronic under nutrition is stunting (Elia, 2017). In children aged 5 to 7 around the world, under nutrition is still a common problem. In 2020, there were 149.2 million children who were stunted and 45.5 million who were wasting, representing prevalence rates of 22% and 6.7%, respectively. At least 30% of children under the age of five were stunted in three regions (West and Central Africa, East and Southern Africa, and South Asia), or 33 nations, in 2020.

Table 2: Overall Prevalence of Parasites in Relation to Class of Pupils in all four schools

CLASS	No EXAMINED	No INFECTED	HK (%)	TT (%)	SS (%)	HY (%)	E.V (%)	ISO (%)	AS (%)	TA (%)	MI (%)	P-value
Pry One	400	41 (10.3)	14 (34.14)	10 (24.4)	10 (24.4)	0 (0.0)	3 (7.3)	0 (0.0)	0 (0.0)	2 (4.9)	2 (4.9)	(*0.000)
Pry Two	400	40 (10.0)	14 (35.0)	10 (25.0)	10 (25.0)	2 (5.0)	0 (0.0)	1 (2.5)	3 (7.5)	0 (0.0)	0 (0.0)	
Pry Three	400	45 (11.3)	26 (57.8)	10 (22.2)	2 (4.4)	0 (0.0)	3 (6.7)	1 (2.2)	3 (6.7)	0 (0.0)	0 (0.0)	
Pry Four	400	50 (12.5)	30 (60.0)	15 (30.0)	2 (4.0)	2 (4.0)	0 (0.0)	0 (0.0)	1 (2.0)	0 (0.0)	0 (0.0)	
Pry Five	400	80 (20.0)	50 (62.5)	15 (18.6)	6 (7.5)	6 (7.5)	0 (0.0)	2 (2.5)	0 (0.0)	0 (0.0)	1 (1.3)	
Total	400	256 (64.0)	134 (52.3)	60 (23.4)	30 (11.7)	10 (3.9)	6 (2.3)	4 (1.6)	7 (2.7)	2 (0.8)	3 (1.2)	

Keys: Pry- Primary, HK- Hookworm, TT- *Trichuris trichiura*, SS- *Strongyloides stercoralis*, HY- *Hymenolepis* eggs, EV- *Enterobius vermicularis*, IS- *Isospora* species, AS- *Ascaris lumbricoides*, TA- *Taenia* eggs, MI- Mixed Infection.
 *Significant P value

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Prevalence of helminthic Infections in relation to Gender and Age of Pupils

Helminthic parasite prevalence was higher in male pupils (74.3%) than in females (56.6%) ($\chi^2= 3.430$) $P= 0.00$. It might be because males spend more time outdoors participating in leisure activities and playing games, whereas female participation is likely lower due to females being required to stay indoors due to religious traditions. Ntoniforet *al.* (2015) in Cameroon and Salawuet *al.* (2014) in Nigeria both reported on similar work. In a study conducted in Ebonyi, Oyiboet *al.* (2011) found that males had considerably higher rates of helminth infection than females, although they recommended that additional research be conducted to determine whether helminth infection is gender-dependent. As regards age, the results also revealed that the prevalence of helminth infections among pupils reduce with age decrease, 5-7 years (59.0%), 7-8 years (62.5%) and 8-9 years (75.0%) ($\chi^2= 36.993$, $P= 0.00$). (Table 3).

This is in contrast to the findings of Salawu and Ughele (2015) and Ukibeet *al.* (2018), which show that children aged 5 to 7 years are active and play with a wide variety of objects and foods. In support of our findings, Alemuet *al.* (2019) and Alelignet *al.*

(2015) discovered in independent research that school-age children aged 10 to 14 years are more active and involved in agricultural activities than younger children, putting them at a higher risk of parasite illness. Mixed infections have been discovered in school-aged children in Nigeria and Uganda. (Ukpong and Agamse 2018; Ojjaet *al.*, 2018). Agbolade *et al.* (2007) and Salawu and Ughele (2015) found that *A. lumbricoides* and hookworm were the most common concurrent infections among school-age children in southern Nigeria. Co-infections, rather than isolated infections, are thought to account for the majority of helminthic infections in Africa (Salawuet *al.*, 2014). This is supported by common epidemiological factors that promote disease spread. Mixed infections were found to be more common in males (1.3%) than in females (1.0%) in this study. According to Yu *et al.* (2017), a study conducted in Northern Samar, Philippines, produced comparable results. According to Rujeniet *al.* (2017)'s research in Rwanda, soil-transmitted helminth co-infection has been shown to affect morbidity, which can have a negative socioeconomic impact on households.

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Table 3: Prevalence of Helminth Infections in relation to Gender and Age of Pupils

Gender	No examined	No Infected	HK (%)	TT (%)	SS (%)	HY (%)	EV (%)	IS (%)	AS (%)	TA (%)	MI (%)	P-value
Male	210	156 (74.3)	80 (51.3)	40 (25.6)	15 (9.6)	6 (3.8)	4 (2.6)	2 (1.3)	5 (3.2)	2 (1.3)	2 (1.3)	*0.000
Female	190	100 (56.6)	54 (28.4)	20 (20.0)	15 (15.0)	4 (4.0)	2 (2.0)	2 (2.0)	2 (2.0)	0 (0.0)	1 (1.0)	
Total	400	256 (64.0)	134 (52.3)	60 (23.4)	30 (11.7)	10 (3.9)	6 (2.3)	4 (1.6)	7 (2.7)	2 (0.8)	3 (1.2)	
Age												
5-7	200	118 (59.0)	89 (75.4)	10 (8.5)	10 (8.5)	2 (1.7)	2 (1.7)	1 (0.8)	1 (0.8)	2 (1.7)	2 (1.7)	0.064
7-8	96	60 (62.5)	25 (41.7)	10 (16.7)	12 (20.0)	3 (5.0)	4 (6.7)	2 (3.3)	3 (5.0)	0 (0.0)	1 (1.7)	
8-9	104	78 (75.0)	20 (25.6)	40 (51.3)	8 (10.3)	6 (7.7)	0 (0.0)	1 (1.28)	3 (3.8)	0 (0.0)	0 (0.0)	
Total	400	256 (64.0)	134 (52.3)	60 (23.4)	30 (11.7)	10 (3.9)	6 (2.3)	4 (1.6)	7 (2.7)	2 (0.8)	3 (1.2)	

Keys: HK- Hookworm, TT- *Trichuristrichuira*, SS- *Strongyloidesstecoralis*, HY- *Hymenolepis* eggs, EV- *Enterobiusvermicularis*, IS- *Isospora* species, AS- *Ascariislumbricoides*, TA- *Taenia* eggs, MI- Mixed Infection.

* Significant P value

CONCLUSIONS

The findings from this study show that Zaria Local Area of Kaduna State is highly endemic to helminth infections in varying magnitude among school children. Hookworm has the highest prevalence rate of other parasite infections. The prevalence of helminth infections was more in male pupils than in females. There is a significant decrease in the prevalent rate of helminth infections with age. Holistic control measures including treatment of infected schoolchildren, regular deworming exercise, health education and organization of sensitization, improvement of environmental hygiene and sanitation, and provision of clean water are very important indicators in the control of helminth infection.

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