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Prevalence of *Ascaris lumbricoides* and Hookworm among Primary School Pupils in Ilorin East Local Government Area in Kwara State

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ABSTRACT

Intestinal parasitic infections continue to constitute a serious public health concern, especially in low-resource settings where children are most vulnerable. Globally, more than two billion individuals are affected, with *Ascaris lumbricoides* and hookworm ranking among the most widespread helminths and contributing substantially to disease burden. This study investigated the occurrence of *Ascaris lumbricoides* and hookworm infections among pupils attending selected primary schools in Ilorin, Kwara State, Nigeria. A descriptive cross-sectional study was carried out involving 216 pupils recruited from three community-based primary schools. Stool specimens were obtained and analysed using direct wet preparation and concentration methods. Information on socio-demographic characteristics, sources of drinking water, and sanitation facilities was collected using structured questionnaires. Statistical analysis was performed with SPSS, and significance was determined at $p < 0.05$. The combined prevalence of intestinal helminth infections was 25.0 %. Infection with *Ascaris lumbricoides* was identified in 32 pupils (14.8%), hookworm in 19 pupils (8.8%), while 3 pupils (1.4%) had concurrent infections. Prevalence rates differed significantly across the three schools studied ($p < 0.05$). Children aged 1–5 years recorded the highest level of infection ($p < 0.05$). Additionally, both water source and toilet facility type showed significant associations with infection status ($p < 0.05$). The findings indicate a considerable burden of *Ascaris lumbricoides* and hookworm infections among the pupils, underscoring the need for focused deworming initiatives, improved sanitation, and sustained health education to minimise transmission and improve children's health and academic performance.

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1.0 Introduction

Intestinal parasitic infections (IPIs) continue to constitute a significant public health concern in many settings, particularly among children in developing regions [1]. Globally, over 2 billion individuals are estimated to be infected with IPIs, while more than half of the world's population remains at risk [2]. Beyond their contribution to morbidity and mortality, intestinal parasites have been linked to growth impairment, undernutrition, physical debility, and poor academic performance among children [3]. In pursuit of the long-term objective of reducing IPIs as a public health burden, the World Health Organisation (WHO) advocates periodic mass drug administration (MDA) using a single oral dose of mebendazole or albendazole for preschool- and school-aged children [4,5].

Parasitic infections, mainly caused by helminths and protozoa, have persistently affected human populations. Notable parasites include *Ascaris lumbricoides*, *Trichuris trichiura*, *Taenia* species, *Schistosoma haematobium*, and Hookworm. Hookworm is a nematode parasite that inhabits the small intestine of mammals such as humans, dogs, and cats. The two species that commonly infect humans are *Ancylostoma duodenale* and *Necator americanus*, both recognised for their aggressive blood-feeding behaviour [6]. Anaemia, arising from chronic iron and protein loss, represents the most severe outcome of Hookworm infection [7]. Estimates indicate that a single *A. duodenale* consumes about 150 microliters of blood daily, whereas *N. americanus* ingests approximately 30 microliters, although this blood loss is not grossly apparent [8]. Globally, around 740 million people are infected with Hookworm, with the highest prevalence reported in Sub-Saharan Africa and Eastern Asia[1].

Transmission occurs through skin penetration or ingestion of infective larvae via contaminated soil, food, water, or unwashed fruits, as well as through the use of human faeces as manure [9]. The health consequences include growth retardation, cognitive impairment, gastrointestinal discomfort, musculoskeletal pain, fatigue, and reduced productivity, particularly among school-aged children and pregnant women [6,8].Conversely, *Ascaris lumbricoides* is the largest and most prevalent human intestinal roundworm and belongs to the group of soil-transmitted helminths, also known as geohelminths [10,11,12]. Intestinal helminth infections affect nearly half of the global population, with children being the most susceptible [13]. School-aged children are commonly exposed through contact with contaminated soil, poor hand hygiene, and consumption of contaminated fruits and vegetables [14].

Infection with *A. lumbricoides* may damage the intestinal mucosa, resulting in reduced nutrient absorption and loss of appetite [15]. Such infections contribute to anaemia, malnutrition, stunting, underweight status, and poor academic performance, thereby negatively influencing children's cognitive development, nutritional well-being, and overall health [14,16]. Given these public health concerns, this study was designed to determine the prevalence of Hookworm and *Ascaris lumbricoides* infections among pupils in selected primary schools in Ilorin East, namely Panada Primary School, Agbeyangi Community Primary School, and Oke-Ose Primary School. These schools were chosen due to their suboptimal environmental and sanitation conditions, which may enhance the transmission of soil-transmitted helminths. Assessing infection prevalence in these settings provides localized epidemiological data that reflect the parasitic disease burden in vulnerable school-age populations and supports the development of targeted school- and community-based control interventions.

2.0 Materials and Methods

2.1 Study Area

The research was conducted in three primary schools located within Ilorin East Local Government Area of Kwara State, Nigeria: Panada Community Primary School, Agbeyangi Community Primary School, and Oke-Ose Primary School. Kwara State lies in the North-Central region of Nigeria and covers an estimated land area of about 36,823 km². The state has an approximate population of 3,390,330 and is regarded as one of the least densely populated states in the country. Ilorin, the state capital, is a historic emirate town and serves as the administrative centre of Kwara State. It shares boundaries with the Republic of Benin to the west, Niger State to the north, Kogi State to the east, and

Ekiti, Osun, and Oyo States to the south [19]. Ilorin East is one of the local government areas in Kwara State, with its administrative headquarters situated in Oke-Oyi. The local government occupies an area of about 486 km² and had an estimated population of 311,500 as of March 2022 [20].

2.2 Study Design and Study Population

This is a cross-sectional experimental study. The study included all pupils who are attending Panda Community Primary School, Agbeyangi Primary School and Oke-Ose Primary School from June to July 2023.The study recruited pupils who voluntarily agreed to participate in the study.

2.3 Sampling Method

Participants were selected using a simple random sampling method, in which all eligible pupils had an equal chance of being included, thereby minimizing selection bias and ensuring a representative sample. A list of pupils who met the inclusion criteria was obtained from each selected school, and participants were then chosen randomly using a balloting method.

2.4. Inclusion and Exclusion Criteria

2.4.1 Inclusion Criteria

The study included all pupils within the age range of 1-15years attending Panda Community Primary School, Agbeyangi Primary School, and Oke-Ose Primary School, Ilorin, Kwara State, within the period of the study.

2.4.2 Exclusion Criteria

Pupils who were currently on anti-helminth treatment, those who were above 15years and below 1 year of age and pupils who did not attend the selected primary schools during the period of study were excluded

2.5 Ethical Consideration

Ethical approval was obtained from the Kwara State Ministry of Health, Ilorin, Kwara State, Nigeria, with identification number ERC/MOH/2023/05/117, and a questionnaire was used to get the socio-demographic characteristics of the study participants.

2.6 Sample Size

The sample size was determined using the formula as described by [21].

$N=Z^2 P (1-P)/C^2$

Where N= Sample size

Z=1.96

P=Prevalence of Hookworm infection in Ilorin (17%)

C = 0.05 (confidence interval or tolerance)

$N = (1.96)^2 x 0.17(1-0.17)$

$(0.05)^2$

N = 3. 8416 x 0.32 x (0.83)

0.0025

N= 3.8416 x 0.1411

0.0025

N= 216

The sample size for the study was 216**.**

2.7 Specimen Collection

Faecal (stool) samples were collected into a clean, wide-mouthed, screw-cap universal container with detailed data from the pupils, such as their name and identity number. The sample was taken to the laboratory for processing.

2.8 Sample Processing

2.8.1 Macroscopy

The samples were observed macroscopically for colour, consistency, mucus, blood and segments of the cestode and adult parasites.

2.8.2 Microscopically

Microscopic examination of the faecal sample was carried out using two methods: Wet mount preparation and the concentration method.

2.8.2.1 Wet Mount Technique

Saline Method

A drop of normal saline was placed on a clean microscope slide using an applicator stick. A small portion of the stool sample was then added and thoroughly mixed with the saline to obtain a uniform suspension. The preparation was covered with a coverslip and examined microscopically using the ×10 objective lens, with findings further verified under the ×40 objective lens [22].

Iodine method
A drop of iodine solution was dispensed onto the centre of a clean slide. Using an applicator stick, a small amount of the faecal specimen was collected and gently mixed with the iodine to form a homogeneous suspension. The preparation was then covered with a coverslip and examined under the ×10 objective lens, with confirmation carried out using the ×40 objective lens [22].

2.8.2.2 Formol Ether Concentration Technique

Approximately 1 g of each stool specimen was transferred with an applicator stick into a screw-cap bottle containing 4 ml of 10% formol water and mixed to obtain a uniform emulsion. An additional 3 ml of formalin water was added, after which the bottle was securely capped and shaken thoroughly. The resulting mixture was filtered through a sieve into a beaker and then poured into a centrifuge tube. Subsequently, 3 ml of diethyl ether was added to the tube, which was stoppered and shaken vigorously for about one minute. The stopper was then removed, and the mixture was centrifuged at 3000 rpm for one minute. Following centrifugation, the layer of faecal debris adhering to the sides of the tube was gently loosened using a stick. The supernatant layers, consisting of ether, debris, and formalin water, were carefully decanted, leaving the sediment at the bottom. The tube was tapped gently to resuspend the sediment evenly. A drop of the sediment was placed on a clean slide, covered with a coverslip, and examined microscopically using the ×10 and ×40 objective lenses [22].

2.9 Statistical Analysis

Chi-square test was used to determine the level of significance or variation between gender, age groups, source of water and types of toilet facilities. P-value less than 0.05 ($p < 0.05$) was considered significant, and the Statistical Package for social science (SPSS) version 21.0 was used.

3.0 Results

In this study, 216 stool samples were examined. The overall prevalence of *Ascaris lumbricoides* and Hookworm parasitic infection among the study participants was (25.0%). Out of which, 32 (14.8 %) were infected with *Ascaris lumbricoides*, 19 (8.8 %) were infected with Hookworm species and 3 (1.4 %) were infected with both *Ascaris lumbricoides* and Hookworm species. Table 1 shows the socio-demographic characteristics of the study participants. Out of the 216 participants, 119 (55.1 %) were male, and 97 (44.9 %) were female. About half of the study participants were within the age of 11-15 years, 107 (49.5 %), followed by those within the age of 5-10 years, 85 (39.4 %), and the least age groups were within the age of 1-5 years, 24 (11.1 %). The source of drinking water by the study

participants was mostly well water 121(56%), followed by those who drink tap water 54(25.0%) and fewer drink Pound stream water 41(19.0%). Based on the type of toilet used, more than half of the study participants use a Pit latrine 154 (71.3%), followed by those who use Bush 55(25.5%), and only a few of them use a Closet 7 (3.2%) (Table 1).

Table 2 shows that out of 75 stool samples examined in Panada Community Primary School, 14 (6.5 %) of the study participants were infected with *Ascaris lumbricoides,*only 6 (2.8 %) were infected with Hookworm species, and 2 (0.9 %) were infected with both *Ascaris lumbricoides* and Hookworm species. In Agbeyangi Community Primary School, out of 69 stool samples examined, 8(3.7%) of the study participants were infected with *Ascaris lumbricoides*, 9(4.1%) were infected with Hookworm species and 0 (0.0%) were infected with both *Ascaris lumbricoides* and Hookworm species. Also in Oke-Ose Primary School, 72 stool samples were examined, out of which 10(4.6%) of the study participants were infected with *Ascaris lumbricoides*, 4(1.9%) were infected with Hookworm species, and 1(0.5%) was infected with both *Ascaris lumbricoides* and Hookworm species.

Table 3 shows the prevalence of *Ascaris lumbricoides* and Hookworm among the study participants in relation to sex. Among the male study participants, a total of one hundred and nineteen (119) stool samples were examined, of which 21(9.7%) of the study participants were infected with *Ascaris lumbricoides*, 14 (6.5%) were infected with Hookworm species and 3 (1.4%) were infected with both *Ascaris lumbricoides* and Hookworm species. Among the female study participants, out of 97 stool samples examined, 11 (5.1 %) were infected with *Ascaris lumbricoides*, 5 (2.3 %) were infected with Hookworm species, and none was infected with both *Ascaris lumbricoides* and Hookworm species.

Table 1: Socio-demographic characteristics of the study participants (n=216)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	119	55.1
	Female	97	44.9
Age (years)	1–5	24	11.1
	5–10	85	39.4
	11–15	107	49.5
Sources of drinking water	Tap water	54	25.0
	Well water	121	56.0
	Pond/stream water	41	19.0
Types of toilet used	Water closet	7	3.2
	Bush	55	25.5
	Pit latrine	154	71.3

Table 2: Overall Prevalence of *Ascaris lumbricoides* and Hookworm among the study participants (n=216)

Selected Schools	No. of samples examined	Parasites	Number infected	Prevalence %	
Panada Community Primary School	75	*Ascaris lumbricoides*	14	6.5%	Chi-square = 10.182 df=2 P-value = 0.006
		Hookworm species	6	2.8%	
		*Ascaris lumbricoides*and Hookworm species	2	0.9%	
Agbeyangi Community Primary School	69	*Ascaris lumbricoides*	8	3.7%	Chi-square = 8.588 df=2 P-value = 0.014
		Hookworm species	9	4.1%	
		*Ascaris lumbricoides*and Hookworm species	0	0.0%	
Oke-Ose Community Primary School	72	*Ascaris lumbricoides*	10	4.6%	Chi-square = 8.4 df=2 P-value = 0.015
		Hookworm species	4	1.9%	
		*Ascaris lumbricoides*and Hookworm species	1	0.5%	
Total	216		54	25.0%	

The chi-square test compares prevalence rates across the three schools.

Table 3: Prevalence of *Ascaris lumbricoides* and Hookworm species among the study participants in relation to sex

Sex	Number examined	*Ascaris lumbricoides*		Hookworm species		*Ascaris lumbricoides*&Hookworm species	
		Number infected	% infected	Number infected	% infected	Number infected	% infected
Male	119	21	9.7	14	6.5	3	1.4
Female	97	11	5.1	5	2.3	0	0.0
Total	**216**	32	14.8	19	8.8	3	1.4

Chi-square = 5.607; df = 3; P-value = 0.132

Table 4 shows the prevalence of *Ascaris lumbricoides* and Hookworm species among the study participants in relation to age. Out of 24 stool samples examined among 1-5-year-old study participants, 16 (7.4 %) were infected with *Ascaris lumbricoides*, 5 (2.3 %) were infected with Hookworm species and 2 (0.9 %) were infected with both *Ascaris lumbricoides* and Hookworm species. Among 5-10-year-old study participants, 9 (4.2 %) were infected with *Ascaris lumbricoides*, 10 (4.6 %) were infected with Hookworm species and 1 (0.5%) was infected with both *Ascaris lumbricoides* and Hookworm species. Among 11-15 year-old study participants, 7 (3.2 %) were

infected with *Ascaris lumbricoides*, 4 (1.9 %) were infected with Hookworm species and 0 (0 %) were infected with both *Ascaris lumbricoides* and Hookworm species.

Table 4: Prevalence of *Ascaris lumbricoides* and Hookworm among the study participants in relation to age

Age (years)	Number examined	*Ascaris lumbricoides*		Hookworm species		*Ascaris lumbricoides*&Hookworm species	
		Number infected	% infected	Number infected	% infected	Number infected	% infected
1-5	24	16	7.4	5	2.3	2	0.9
5-10	85	9	4.2	10	4.6	1	0.5
11-15	107	7	3.2	4	1.9	0	0.0
Total	**216**	32	14.8	19	8.8	3	1.4

Chi-square = 40.119; df = 6; P-value = 0.000

Table 5 shows the prevalence of *Ascaris lumbricoides* and Hookworm species among the study participants in relation to the source of drinking water. Among the study participants who drink Tap water, 1 (0.5 %) were infected with *Ascaris lumbricoides*, 0(0.0 %) were infected with Hookworm species and 0 (0.0 %) were infected with both *Ascaris lumbricoides* and Hookworm species. Among those who drink well water, 7 (3.2 %) were infected with *Ascaris lumbricoides*, 4 (1.9 %) were infected with Hookworm species and 0 (0 %) were infected with both *Ascaris lumbricoides* and Hookworm species. Among those who drink Pound stream water, 24 (11.1 %) were infected with *Ascaris lumbricoides*, 15 (6.9 %) were infected with Hookworm species, and 3 (1.4 %) were infected with both *Ascaris lumbricoides* and Hookworm species.

Table 5: Prevalence of *Ascaris lumbricoides* and Hookworm species among the study participants in relation to Sources of drinking water

Sources of drinking water	Number examined	*Ascaris lumbricoides*		Hookworm species		*Ascaris lumbricoides and* Hookworm species	
		Number infected	% infected	Number infected	% infected	Number infected	% infected
Tap water	54	1	0.5	0	0.0	0	0.0
Well water	121	7	3.2	4	1.9	0	0.0
Pound stream water	41	24	11.1	15	6.9	3	1.4
Total	**216**	32	14.8	19	8.8	3	1.4

Chi-square = 72.079; df = 6; P-value = 0.000

Table 6 shows the prevalence of *Ascaris lumbricoides* and Hookworm species among the study participants in relation to the types of toilet used. Among those that use Closet, 1 (0.5%) were infected with *Ascaris lumbricoides*, 0 (0 %) were infected with Hookworm species, and 0% were infected with both *Ascaris lumbricoides* and Hookworm species. Among those that uses Bush, 9 (4.1 %) were infected with *Ascaris lumbricoides*, 12 (5.6 %) were infected with Hookworm species, and 2 (0.9 %) were infected with both *Ascaris lumbricoides* and Hookworm species. Among those that uses Pit Latrine, 22 (10.2 %) were infected with *Ascaris lumbricoides* only, 7 (3.2%) were infected with

Hookworm only, and 1(0.5%) was infected with both *Ascaris lumbricoides* and Hookworm species. Figure 1 shows the overall prevalence of *Ascaris lumbricoides* and Hookworm among the study participants.

Table 6: Prevalence of *Ascaris lumbricoides* and Hookworm species among the study participants in relation to the types of Toilet used

Types of Toilets used	Number examined	*Ascaris lumbricoides*		Hookworm species		*Ascaris lumbricoides*&Hookworm species	
		Number infected	% infected	Number infected	% infected	Number infected	% infected
Closet	7	1	0.5	0	0.0	0	0.0
Bush	55	9	4.1	12	5.6	2	0.9
Pit Latrine	154	22	10.2	7	3.2	1	0.5
Total	**216**	32	14.8	19	8.8	3	1.4

Chi-square = 14.383; df = 6; P-value = 0.026

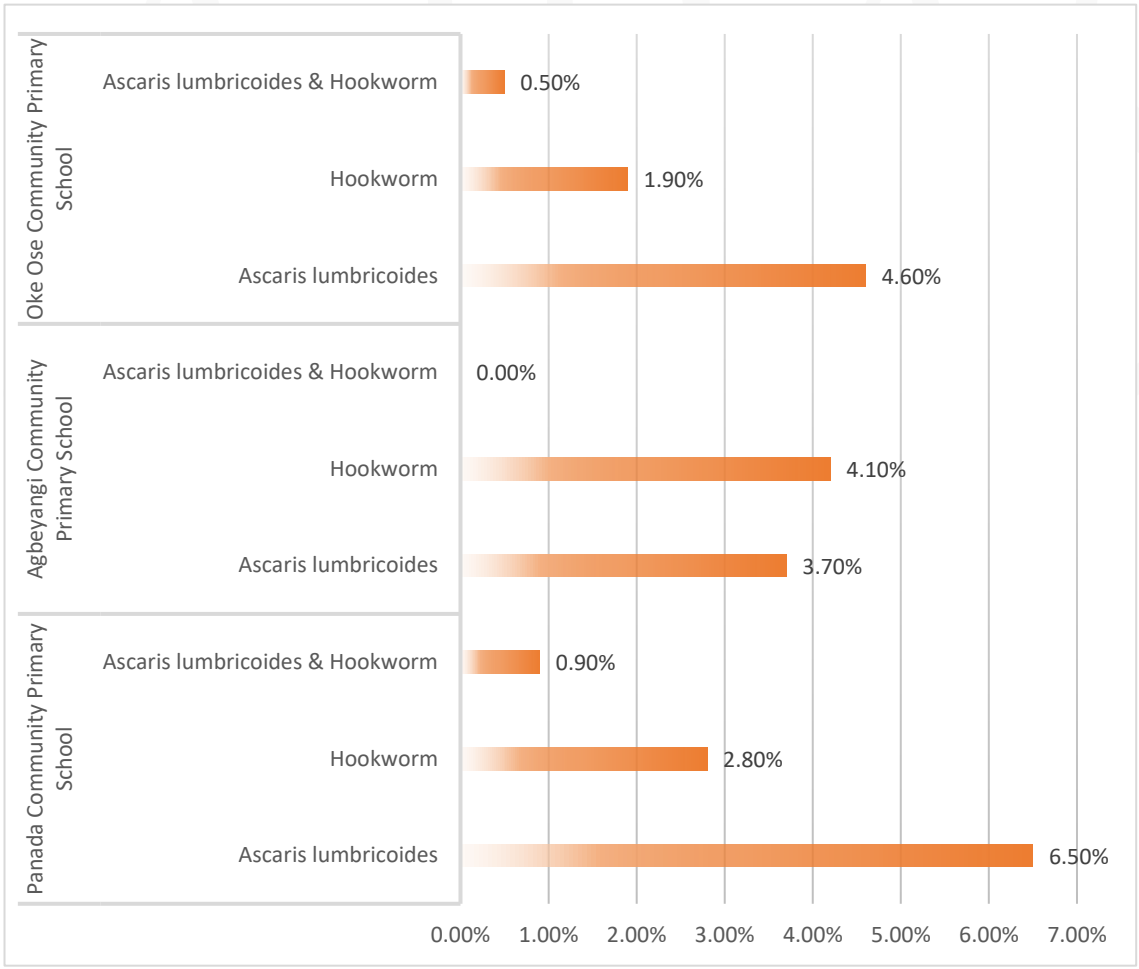

Figure 1: Bar chart showing the overall Prevalence of *Ascaris lumbricoides* and Hookworm among the study participants (n=216)

4.0 Discussion

In this study, the overall prevalence of intestinal parasitic infections was 25.0 %, highlighting a considerable public health challenge among the study population. This prevalence is comparable to the 23.32% reported among primary school pupils in Ilorin, Kwara State [23], as well as the 24.8% documented among school children in Port Harcourt, Nigeria [24]. However, the rate observed in the present study is lower than the higher prevalence figures reported in Ogun State (46.94%) [25], rural areas of Ebonyi State (77.8%) [26], Makurdi (54.13%) [27], Benue State (58.5%) [28], Ethiopia (77.9%) [29], Enugu State (52.5%) [30], and Nigerian urban slums (86.2%) [31]. Conversely, the prevalence recorded in this study exceeds the lower rates reported among school children in Ghana (15%) [32], southeastern Nigeria (16.9%) [33], and Chikun and Kaduna South Local Government Areas of Kaduna State (15.75%) [34]. Differences in prevalence across locations may be explained by variations in environmental sanitation and personal hygiene practices. The association between age and the prevalence of intestinal parasites observed in this study is consistent with reports by several authors, who have shown that age significantly influences parasitic infections among school-aged children [34,35,36]. The relatively higher prevalence observed among pupils aged 1–5 years (0.9%) may be linked to age-related behaviours. Children in this age group frequently engage in outdoor activities such as playing football and other games that increase contact with contaminated soil, thereby elevating the risk of infection. Although earlier studies [34,35,36] have indicated that intestinal parasitic infections tend to decline with increasing age, this reduction is often attributed to improved hygiene practices and greater health awareness as children grow older. A slightly higher prevalence of parasitic infections was observed among male pupils in this study, suggesting possible implications for transmission patterns. Male children are typically more involved in outdoor activities, which may increase exposure to contaminated soil and water sources, thereby contributing to higher infection rates [37]. Several studies have reported a significant association between sex and intestinal parasitic infections, with males being more frequently affected than females [38,39,40]. Cultural and religious practices may further influence this pattern, as males are often granted greater freedom to play outdoors, increasing contact with soil containing infective stages of parasites, while females may have more restricted outdoor exposure [41]. Among male participants, infection rates of *Ascaris lumbricoides* and Hookworm were notably higher. Activities that involve direct contact with soil, such as outdoor play and farming, may account for this observation, as larvae of these parasites can be transmitted through contaminated soil. The recorded co-infection rate of 1.4% among males suggests exposure to multiple risk factors, including walking barefoot and poor hygiene practices. Female participants exhibited lower prevalence rates of both parasites, possibly due to reduced exposure associated with spending more time indoors. Nonetheless, sex was not statistically associated with the prevalence of *Ascaris lumbricoides* and Hookworm in this study. This agrees with the findings of Taiwo and Agbolade[42], who reported equal susceptibility to parasitic infections among both sexes. Similarly, Suresh *et al*. [43] observed nearly equal infection rates between males and females, while Umeh *et al.*[44] found no significant sex-based difference in the prevalence of intestinal helminths in Uga, Anambra State, Nigeria. These observations suggest that both sexes may experience similar levels of exposure to intestinal parasites. The type of toilet facility used by participants was identified as an important factor influencing parasitic infections in this study. Pit latrines (0.5%), which were the most commonly used facilities, were associated with poor sanitation and a higher likelihood of environmental faecal contamination. This observation corresponds with the elevated prevalence of parasitic infections, as inadequate sanitation promotes transmission. Flush toilet users recorded the lowest prevalence of *Ascaris lumbricoides* and Hookworm, likely due to better waste disposal and reduced exposure to contaminated soil. Participants who practised open defecation using bush toilets (0.9%) showed a higher prevalence of both parasites, which may be attributed to increased exposure to infective stages present in the soil. While pit latrine users had the highest prevalence of *Ascaris lumbricoides*, they exhibited a lower prevalence of Hookworm compared to bush toilet users, possibly due to partial containment of faecal matter in pit latrines. These findings are consistent with those of Ibrahim *et al.* [23], who reported widespread use of latrines among school children in their study. The type of sanitation facility used often reflects the socio-economic status of pupils' households. Children relying on traditional toilet systems may have limited access to proper hygiene practices, thereby increasing the risk of fecal–oral transmission of intestinal parasites. Consequently, the

availability and use of adequate sanitation facilities play a crucial role in preventing parasitic infections. These findings underscore the need for improved sanitation infrastructure in communities with inadequate facilities. Furthermore, a higher prevalence of parasitic infection was observed among pupils who depended on stream water (1.4%) compared to those who used tap water (0.0%). This observation is consistent with Ibrahim *et al*. [23], who reported increased parasitic infections among children consuming stream water compared with those who had access to treated tap water for drinking and domestic purposes. The overall prevalence rate of 25.0% among pupils is substantial and calls for urgent public health intervention. Government efforts aimed at providing safe drinking water, improved sanitation facilities, and routine deworming programs, as recommended [45], would significantly reduce the burden of parasitic infections. In addition, health education initiatives targeting schools and communities to promote proper hygiene practices, safe water use, and improved sanitation would further contribute to reducing the risk of infection.

5.0 Conclusion

The investigation of *Ascaris lumbricoides* and Hookworm infections among primary school pupils in Ilorin East underscores a notable public health challenge, largely driven by poor environmental sanitation, inadequate personal hygiene, and insufficient access to safe drinking water. Tackling this problem requires the implementation of routine deworming programs, sustained health education, and the provision of improved sanitation facilities within schools and surrounding communities. In addition, broader community-based interventions, including effective waste management systems, reliable sources of clean water, and increased parental awareness, are vital. A coordinated approach involving government authorities, educational institutions, and community leaders is therefore necessary to lessen the impact of these infections and enhance the overall health and academic outcomes of the affected pupils.

Declaration of Generative Tool

The authors acknowledge and take full responsibility for the use of a generative AI tool (ChatGPT) in this work. ChatGPT was used specifically for paraphrasing purposes, with the intention of improving clarity and coherence while preserving the original meaning of the content. The motivation for using this tool lies in the role of artificial intelligence as an instrument for innovation, as it supports the development of new approaches and more efficient ways of performing tasks across diverse fields. The final content was carefully reviewed, verified, and refined, and the Authors remain fully accountable for its accuracy, originality, and academic integrity.

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