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PREVALENCE AND RISK FACTORS ASSOCIATED WITH INTESTINAL HELMINTH INFECTIONS AMONG SCHOOL CHILDREN IN ADAMAWA CENTRAL ZONE, NIGERIA

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ABSTRACT

Intestinal helminth infections continue to pose substantial public health challenges in many parts of Nigeria, particularly in rural and peri-urban communities with inadequate sanitation and unsafe water sources. This study investigated behavioural and environmental risk factors associated with intestinal helminth infections among 1,496 school-aged children in Adamawa Central Zone. Stool samples were examined using the formol-ether concentration technique, while structured questionnaires assessed sanitation practices, water sources, hygiene habits, and household environmental conditions. A total of 578 pupils were infected, representing an overall prevalence of 38.6%. Significant associations were observed between infection and sanitation facility used, source of drinking and cooking water, handwashing practices, nail trimming, wearing of shoes, standing water around homes, domestic animal ownership, and proximity to health facilities ($p < 0.05$). River/stream water users, children practicing open defecation, and those with poor hygiene practices exhibited higher infection burdens. These findings underscore the importance of integrating mass deworming with improvements in water, sanitation, hygiene (WASH), environmental management, and community health outreach to achieve sustainable reduction in transmission.

Keywords: Soil-Transmitted Helminths, Risk Factors, Hygiene, Sanitation, School Children, Adamawa Central Zone

INTRODUCTION

Intestinal helminth infections are parasitic worm infections of the gastrointestinal tract and include soil-transmitted helminths (STHs) such as *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms (World Health Organization [WHO], 2023; Bethony et al., 2006). While STHs constitute the major proportion of intestinal helminths in endemic regions, intestinal helminthiasis is a broader category encompassing all helminths detected in stool samples. This study focuses on intestinal helminths identified among school-aged children, with particular epidemiological relevance to STH species due to their dominant transmission patterns in Nigeria.

Intestinal helminth infections remain highly prevalent in sub-Saharan Africa, particularly in areas characterized by poor sanitation, unsafe water sources, and inadequate hygiene practices (Gebrezgabiher et al., 2024; Montresor et al., 2021). In Nigeria, school-aged children bear a disproportionate burden, experiencing consequences such as anemia, malnutrition, impaired growth, and reduced academic performance (Ngui et al., 2023; Hotez & Kamath, 2009). Although mass drug administration (MDA) programmes are implemented periodically, reinfection remains common due to persistent environmental contamination and behavioural risk factors (Udonwa et al., 2023; Oyewole et al., 2023).

In Adamawa Central Zone, limited recent data exist on the specific behavioural and environmental determinants sustaining intestinal helminth transmission. The continued presence of open defecation, reliance on untreated water sources, livestock rearing, and uneven access to healthcare services may contribute to persistent infection. However, without localized evidence, intervention strategies remain generalized and may fail to address context-specific drivers.

This study was therefore conducted to determine the prevalence of intestinal helminth infections and to examine their association with sanitation practices, water sources, personal hygiene behaviours, environmental conditions, and healthcare accessibility among school-aged children in Adamawa Central Zone, Nigeria.

Research Questions

i. What is the prevalence of intestinal helminth infections among school-aged children in Adamawa Central Zone?
ii. Are sanitation, water source, hygiene practices, and environmental factors significantly associated with infection?

Research Hypotheses

H_{01}: There is no significant association between sanitation practices and intestinal helminth infection.
H_{02}: There is no significant association between water source and intestinal helminth infection.
H_{03}: Personal hygiene and environmental factors are not significantly associated with intestinal helminth infection.

MATERIALS AND METHODS

Study Area

The study was conducted in Adamawa Central Zone, Nigeria, located between latitude 8°30′N and 13°00′N and longitude 10°30′E and 13°00′E, with an average elevation of approximately 135 m above sea level. The zone covers about 12,914 km² and comprises seven LGAs: Yola North, Yola South, Fufore, Girei, Song, Hong, and Gombi. The area lies within the Sudan Savannah ecological zone, characterized by high temperatures (up to 40°C in April), seasonal rainfall, and low-lying plains drained mainly by the River Benue. Communities rely heavily on farming, livestock rearing, and surface water sources.

Cultural and environmental practices that may influence helminth transmission include open defecation, use of pit latrines, barefoot walking during farming and herding, livestock within household compounds, and dependence on untreated river or stream water.

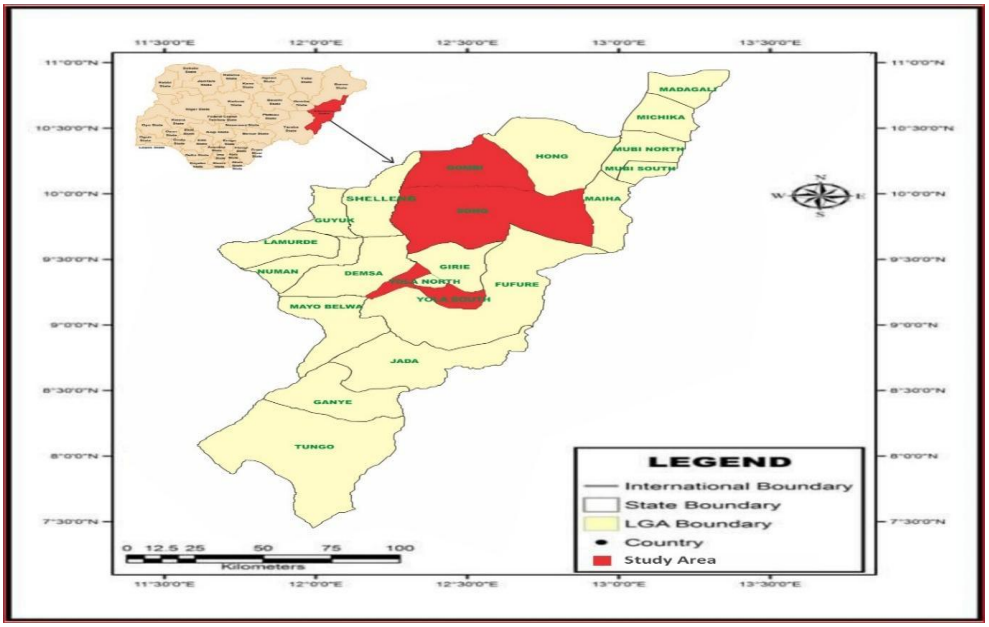

Figure 1: Map of Adamawa State showing Various LGAs and the Study Area
Source: Adamawa State Ministry of Urban and Rural Development

Study Design and Sampling

A cross-sectional study was conducted between May and August 2025 among 1,496 school-aged children (5–15 years) selected using multistage sampling from Song, Gombi, Fufore, and Yola South LGAs.

Parasitological Examination

Stool samples were collected in labelled sterile containers and examined using the formol-ether concentration technique for identification of intestinal helminth ova.

Questionnaire Design and Administration

A structured questionnaire was developed to collect data on sanitation practices, water sources, hygiene behaviours, environmental exposure, and healthcare access. The instrument was validated by experts and pretested outside the study area before use. Questionnaires were administered through interviewer-assisted responses.

Statistical Analysis

Data were analyzed using Minitab Statistical Software Version 20. Descriptive statistics summarized prevalence, and Chi-square (χ^2) tests assessed associations between risk factors and infection. Statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

Behavioral Risk Factors

As given in Table 1. Sanitation type showed a strong association with infection. Pupils using pit latrines (43.4%) and those practicing open defecation (41.1%) had higher infection rates than those using flush toilets (32.8%) ($\chi^2 = 9.458$, $p < 0.05$). Water source for drinking similarly influenced prevalence ($p = 0.002$), with the highest rates recorded among pupils who depended on river or stream water (52.1%), compared to borehole users (37.9%) and tap water users (30.5%) ($\chi^2 = 11.643$, $p < 0.05$).

Hand hygiene was an important determinant. Children who never washed hands before eating had an infection prevalence of 44.4%, compared with 31.2% among those who always washed their hands ($\chi^2 = 13.275$, $p < 0.05$). A similar pattern was observed for washing hands after using the toilet, where inconsistent handwashing (49.6% versus 31.0%) significantly increased infection risk ($\chi^2 = 10.834$, $p < 0.05$).

Personal hygiene practices, such as nail trimming and wearing shoes, were also significant predictors. Pupils who did not trim their nails regularly had a higher prevalence (44.5%) than those who did (31.3%) ($\chi^2 = 8.491$, $p < 0.05$). Walking barefoot increased infection risk, with barefooted pupils recording a prevalence of 47.2%, compared to 30.8% among those who regularly wore shoes ($\chi^2 = 12.639$, $p < 0.05$).

Table 1: Prevalence of Intestinal Helminths Based on Behavioural Risk Factors

Variable	Options	No. Examined	No. Infected	Prevalence (%)	χ^2	p-value
Toilet Facility Used	Flush Toilet	580	190	32.8	9.458	0.009
	Pit Latrine	495	215	43.4		
	Open Defecation	421	173	41.1		
Source of Drinking Water	Tap Water	590	180	30.5	11.643	0.002
	Borehole	522	198	37.9		
	River/Stream	384	200	52.1		
Washing Hands Before Eating	Always	625	195	31.2	13.275	0.001
	Sometimes	560	245	43.8		
	Never	311	138	44.4		

Variable	Options	No. Examined	No. Infected	Prevalence (%)	χ^2	p-value
Washing Hands After Toilet Use	Always	654	203	31.0	10.834	0.004
	Sometimes	570	240	42.1		
	Never	272	135	49.6		
Regular Nail Trimming	Yes	670	210	31.3	8.491	0.014
	No	826	368	44.5		
Wearing Shoes	Yes	780	240	30.8	12.639	0.002
	No	716	338	47.2		

Environmental Risk Factors

As shown in Table 2, which is environmental variables also showed strong associations with infection. Environmental conditions around households further influenced infection. Pupils living in homes surrounded by standing water had higher prevalence (43.5%) than those without such exposure (34.2%) ($\chi^2 = 9.458$, $p < 0.05$). Water used for cooking showed a similar gradient: river/stream users had the highest prevalence (51.6%), followed by borehole (38.3%) and tap water (30.5%) ($\chi^2 = 11.643$, $p < 0.05$).

Domestic animal ownership significantly increased infection risk. Pupils from households with pets or livestock recorded 44.9% prevalence, compared to 30.0% among those without animals ($\chi^2 = 13.275$, $p < 0.05$). Availability of a nearby health facility also influenced infection; children living in communities lacking health workers or facilities had a significantly higher prevalence (48.6%) compared to those with access to healthcare services (33.2%) ($\chi^2 = 10.834$, $p < 0.05$).

Environmental Risk Factors

Table 2 shows that environmental conditions were also significantly associated with infection ($p < 0.05$). Pupils exposed to standing water, those using river/stream water for cooking, children from households with domestic animals, and those without access to nearby health facilities had significantly higher infection prevalence.

Table 2: Prevalence of Intestinal Helminths Based on Environmental Risk Factors

Variable	Options	No. Examined	No. Infected	Prevalence (%)	χ^2	p-value
Standing Water Around Home	Yes	712	310	43.5	9.458	0.001
	No	784	268	34.2		
Source of Water for Cooking	Tap Water	590	180	30.5	11.643	<0.001
	Borehole	522	200	38.3		
	River/Stream	384	198	51.6		
Pets/Animals at Home	Yes	869	390	44.9	13.275	0.002
	No	627	188	30.0		
Availability of Health Facility Nearby	Yes	965	320	33.2	10.834	0.004
	No	531	258	48.6		

Discussion

This study demonstrated that intestinal helminth infections remain highly prevalent (38.6%) among school-aged children in Adamawa Central Zone, indicating ongoing transmission despite periodic deworming efforts. The findings suggest that environmental contamination and behavioural exposure continue to sustain infection cycles in the region. Sanitation facility was significantly associated with infection. Children who used pit latrines or practiced open defecation had higher prevalence compared to those using flush toilets. This implies that inadequate sanitation infrastructure contributes directly to environmental contamination with helminth eggs, thereby increasing exposure risk. Open defecation and poorly constructed pit latrines allow parasite ova to persist in soil, especially under warm and moist climatic conditions typical of the Sudan Savannah zone. Similar findings have been reported in northern Nigeria and other endemic settings, where poor sanitation significantly predicted soil-transmitted helminth (STH) infection (Ochei et al., 2022; Asaolu & Ofoezie, 2003). Comparable patterns were also documented in East Africa (Gebrezgabiher et al., 2024). The similarity across regions reinforces the critical role of sanitation improvement in interrupting helminth transmission (World Health Organization [WHO], 2022).

Source of drinking and cooking water was another significant determinant. Children relying on river or stream water had markedly higher infection rates than those using tap or borehole water. This finding implies that untreated surface water may serve as a vehicle for ingestion of infective helminth eggs. In rural communities, rivers are often contaminated by upstream open defecation and livestock activity, increasing microbial and parasitic load. Similar associations have been reported in southwestern and northern Nigeria (Ajayi & Adebayo, 2022; Ekpenyong & Dike, 2022). The consistency of this result with previous research underscores the importance of safe water supply in reducing ingestion-based transmission of *Ascaris* and *Trichuris* species (WHO, 2023).

Personal hygiene practices also showed strong associations with infection. Children who did not consistently wash their hands, trim their nails, or wear shoes had significantly higher prevalence. These findings imply that behavioural exposure pathways remain active contributors to transmission. Untrimmed fingernails can harbor infective eggs, while inadequate handwashing facilitates oral ingestion of contaminated particles. Walking barefoot increases the risk of hookworm larval penetration through the skin. Similar findings have been documented in Nigerian school-based studies (Oyewole et al., 2023; Udonwa et al., 2023) and

internationally (Adeleke et al., 2023; Akinbo et al., 2023). The similarity suggests that hygiene behaviour remains a universal determinant of intestinal helminth infection.

Environmental conditions further influenced infection risk. The presence of stagnant water around homes was significantly associated with higher prevalence. Although helminths do not multiply in water, moist environments enhance egg survival and increase soil contamination. Additionally, domestic animal ownership was associated with higher infection rates. Livestock and pets may contribute to environmental dissemination of parasite eggs through fecal contamination within household compounds. This aligns with findings linking zoonotic interfaces to increased helminth exposure (Eke et al., 2021). However, some studies have reported weaker associations between animal ownership and STH transmission, possibly due to differences in animal husbandry practices and sanitation infrastructure (Ahmed et al., 2024). Such variations highlight the importance of local ecological and cultural contexts.

Access to nearby health facilities was also significantly associated with infection status. Children living in communities without health facilities had higher prevalence. This implies that limited access to healthcare may delay diagnosis, reduce participation in deworming campaigns, and limit exposure to preventive health education. Similar conclusions were reached by Salawu and Isa (2020), who emphasized the role of accessible primary healthcare in reducing parasitic disease burden. This finding supports the argument that chemotherapy alone is insufficient without integrated community health systems (Mupfasoni & Montresor, 2022; Tchuem Tchuenté, 2024). Overall, the study demonstrates that intestinal helminth transmission in Adamawa Central Zone is driven by an interaction of sanitation deficiencies, unsafe water, hygiene behaviour, environmental exposure, and healthcare access. The findings are largely consistent with national and regional evidence (Gebrezgabiher et al., 2024; Montresor et al., 2021; Awoleye & Olatunji, 2025). Where minor differences occur across studies, they may be explained by ecological variability, climatic conditions, socio-cultural practices, and differences in study design.

CONCLUSION

Intestinal helminth infections in Adamawa Central Zone are strongly influenced by behavioural practices, environmental conditions, and sanitation infrastructure. High-risk factors include unsafe water sources, open defecation, poor hygiene habits, environmental contamination, and lack of access to healthcare.

REFERENCES

Abah, A. E., & Arene, F. O. (2015). Status of intestinal parasitic infections among primary school pupils in Rivers State, Nigeria. *Nigerian Journal of Parasitology, 36*(1), 65–70.

Adebayo, A. A., & Tukur, A. L. (1999). *Adamawa State in maps*. Paraclete Publishers.

Adeleke, M. A., Olafimihan, O., & Dairo, M. D. (2023). Footwear behaviour and hookworm prevalence in endemic communities. *International Journal of Infectious Diseases, 131*, 150–156.

Adeoye, G. O., & Akinsanya, B. (2023). Anthropogenic factors influencing soil-transmitted helminth distribution in Nigeria. *Pan African Medical Journal, 46*, 52.

Ahmed, A., Musa, J., & Umar, K. (2024). Environmental determinants of helminth transmission in northern Nigeria. *Journal of Tropical Medicine and Parasitology, 25*(1), 33–42.

Ajayi, I. O., & Adebayo, A. M. (2022). Water sources and intestinal parasitic infections in southwestern Nigeria. *Journal of Public Health in Africa, 13*, 2065.

Akinbo, F. O., Adeleke, O. C., & Omoregie, R. (2023). Influence of hygiene behaviour and environment on intestinal helminths. *Heliyon, 9*, e14256.

Asaolu, S. O., & Ofoezie, I. E. (2003). The role of sanitation in the control of soil-transmitted helminths. *Acta Tropica, 86*, 283–294.

Awoleye, S. A., & Olatunji, O. P. (2025). Epidemiological overview of helminthiasis in northern Nigeria. *Nigerian Journal of Parasitology, 45*(1), 89–98.

Bethony, J., Brooker, S., Albonico, M., Geiger, A., Loukas, A., & Diemert, D. (2006). Soil-transmitted helminth infections: Ascariasis, trichuriasis, and hookworm. *The Lancet, 367*, 1521–1532.

Blanchard, A., Guégnard, F., Charvet, C., et al. (2018). Cholinergic anthelmintic sensitivity in nematodes: Differences between *Caenorhabditis elegans* and parasitic species. *PLoS Pathogens, 14*(2), e1006854.

Brooker, S., Bethony, J., & Hotez, P. (2006). Human hookworm infection in the 21st century: Epidemiology, impact, and control. *The Lancet, 367*, 1521–1532.

Eke, S. S., Nwosu, A. B., & Ifeanyi, C. (2021). Relationship between domestic animals and transmission of helminths among children. *Parasitology International, 83*, 102375.

Ekpenyong, E. A., & Dike, A. (2022). Water quality and helminth infection prevalence among rural dwellers in Nigeria. *Environmental Health Insights, 16*, 1–10.

Eyo, J. E., & Iboh, C. I. (2021). Health hygiene behaviour and intestinal parasitism in rural schoolchildren. *Journal of Parasitology Research, 2021*, 6654328.

Gebrezgabiher, G., Mekonnen, Z., & Erko, B. (2024). Epidemiology of soil-transmitted helminths in East Africa: A systematic review. *Parasite Epidemiology and Control, 17*, e00245.

Hotez, P. J., & Kamath, A. (2009). Neglected tropical diseases in sub-Saharan Africa: Review of soil-transmitted helminth burden. *New England Journal of Medicine, 362*, 777–779.

Montresor, A., Mupfasoni, D., & Mikhailov, A. (2021). Soil-transmitted helminth control in sub-Saharan Africa: Progress, challenges, and perspectives. *PLoS Neglected Tropical Diseases, 15*(6), e0009482.

Mupfasoni, D., & Montresor, A. (2022). Operational challenges in helminth control programs in Africa. *Tropical Medicine & International Health, 27*(11), 1084–1092.

Ngui, R., Wekesa, A., & Ajayi, A. O. (2023). Persistent burden of intestinal parasitic infections in Nigerian

schoolchildren: A public health challenge. *Journal of Infection and Public Health, 16*(7), 1025–1033.

Nwaneri, A. C., & Ibeabuchi, M. N. (2023). Impact of water access on child health outcomes in Nigeria. *African Journal of Environmental Science and Technology, 17*(5), 201–210.

Ochei, K. C., Adamu, S., & Usman, R. (2022). Sanitary conditions and helminth infections among schoolchildren in northern Nigeria. *Nigerian Journal of Parasitology, 43*(1), 112–120.

Oluwole, A. S., Ekpo, U. F., & Karagiannis-Voules, D. A. (2015). Bayesian geostatistical modelling of helminth risk in Nigeria. *Parasites & Vectors, 8*, 427.

Oyewole, F., Ariyo, S., & Bolaji, O. (2023). Hygiene practices and intestinal parasitic infections among Nigerian schoolchildren. *African Health Sciences, 23*(1), 455–464.

Salawu, S. A., & Isa, A. Y. (2020). The role of health facilities in controlling parasitic infections in underserved communities. *African Journal of Medicine and Medical Sciences, 49*(3), 45–52.

Tchuem Tchuenté, L. A. (2024). Control strategies for helminth infections in Africa. *Current Opinion in Infectious Diseases, 37*(2), 105–112.

Udonwa, N. E., Etim, S. E., & Nkwocha, C. (2023). Sanitation-related determinants of geohelminth infections in rural communities of Nigeria. *Nigerian Journal of Parasitology, 44*(2), 305–314.

World Bank Global Road Safety Facility. (2023). *Understanding WASH challenges in West Africa*. World Bank.

World Health Organization. (2022). *Preventive chemotherapy in human helminthiasis*. World Health Organization.

World Health Organization. (2023). *Soil-transmitted helminth infections: Key facts*. World Health Organization.