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Prevalence of Intestinal Parasites among Nomads in Hong Local Government Area, Adamawa State, Nigeria

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Abstract

Intestinal helminth infections remain a major public health concern in tropical regions, with nomadic populations such as the Fulani in Adamawa State, Nigeria, facing heightened risk due to limited access to sanitation, clean water, and health education. This study assessed the prevalence and associated risk factors of intestinal helminth infections among two nomadic Fulani settlements in Hong Local Government Area (LGA). A community-based cross-sectional study was conducted from July to September 2025 in Warchirashan and Fa'a Fulani settlements. Stool samples (n = 220) were collected from randomly selected participants and analyzed using the concentration method, while socio-demographic data and risk factors for soil-transmitted helminths were obtained via structured questionnaires. Data were analyzed using SPSS v26.0, and associations between infection status and risk factors were assessed using Chi-square tests ($p < 0.05$). The overall prevalence of intestinal helminth infections was 34.5%, with similar rates in Warchirashan (33.6%) and Fa'a (35.5%). The most prevalent parasites were *Ascaris lumbricoides* (11.4%), *Trichuris trichiura* (12.3%), and *Schistosoma mansoni* (11.4%). Single-species infections predominated, although polyparasitism occurred in 33–38% of infected individuals. Age-specific

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prevalence was highest among 18–30-year-olds, consistent with greater occupational exposure, and infection rates were higher in males than females (39.6% vs 25.9%), although this difference was not statistically significant. Significant risk factors included source of drinking water, open/bush defecation, and inconsistent handwashing practices. The study concludes that a moderate prevalence of intestinal helminth infections persists among nomadic Fulani communities in Hong LGA, driven by environmental and behavioral determinants, and recommends integrated control strategies—combining improved sanitation, safe water access, regular deworming, and targeted health education—to reduce the infection burden across all age groups.

Keywords: Intestinal Helminths; Soil-Transmitted Helminths; Nomadic Fulani; Prevalence; Risk Factors.

INTRODUCTION

Intestinal parasitic infections (IPIs), particularly those caused by soil-transmitted helminths (STHs), remain a significant global public health challenge, especially in tropical and subtropical regions where poverty, inadequate sanitation, unsafe water sources, and poor hygiene persist (World Health Organization [WHO], 2021; Echeta, 2023). Globally, over 1.5 billion people are affected, with children disproportionately burdened in sub-Saharan Africa (Pathogens Editorial Team, 2023; WHO, 2021).

In Nigeria, STH infections remain endemic, with recent studies reporting prevalence rates ranging from 16.8% to 24.4% among schoolchildren in rural and urban communities (Adamu, Abd Aziz, Mustafa, & Shohaimi, 2024; Isma'l *et al.*, 2024; Nyamngee, Sanda, & Sulaiman, 2024). Transmission occurs primarily through ingestion of food or water contaminated with human feces or contact with contaminated soil, a risk exacerbated by poor sanitation, open defecation, lack of latrine facilities, and use of untreated water (Echeta, 2023; Isma'l *et al.*, 2024).

While numerous studies have documented prevalence among settled communities, research on nomadic populations remains limited. The nomadic Fulani, whose migratory lifestyle involves searching for pasture and water for their livestock, frequently lack access to formal healthcare, sanitation facilities, and health education, increasing their vulnerability to STH infections (Adamu *et al.*, 2024; Pathogens Editorial Team, 2023). Their reliance on rivers

and streams for drinking water and the absence of structured waste disposal systems create environmental conditions favorable to helminth transmission.

Although some studies have suggested that nomadic populations may experience lower infection rates than settled communities due to reduced population density (Adebayo *et al.*, 2018), recent findings indicate otherwise. In neighboring areas of Adamawa State, high prevalence rates of up to 74.2% have been reported among nomadic Fulani, dominated by *Ascaris lumbricoides* (29.7%) and hookworm (20.5%) infections, highlighting a severe and under-addressed public health burden (Nyamngee *et al.*, 2024).

Despite their socio-economic importance as major producers of milk and livestock products, nomadic groups like the Fulani are often marginalized in public health interventions (Echeta, 2023; WHO, 2021). There is a conspicuous lack of empirical data on the prevalence and associated risk factors of intestinal helminth infections among nomadic Fulani populations in specific areas such as Hong Local Government Area (LGA) of Adamawa State. This study aims to fill that knowledge gap, providing essential baseline data to guide targeted deworming programs, sanitation interventions, and community health education campaigns.

METHODS

Study Design and Area

A community-based cross-sectional study was conducted over a four months period (July–September) among nomadic Fulani populations in Hong Local Government Area (LGA), Adamawa State, Nigeria. Hong LGA is situated within latitude 10°00'00"N and longitude 12°35'00"E to 13°20'00"E. It has an area of 38,741 square kilometres and as a typical tropical African city. The weather conditions are marked by wet and dry seasons. Maximum temperature can reach 40°C while the minimum temperature can reach 18°C (Adamawa State Diary 2015). The study focused on two purposively selected Fulani settlements (Warchirashan and Fa'a Fulani settlements), which were geo-referenced during field reconnaissance. These Warchirashan and Fa'a Fulani communities are characterized by cattle herding as the primary occupation, limited access to improved water and sanitation, and a semi-nomadic lifestyle, creating conditions conducive to parasitic transmission.

The study was carried out among the nomadic Fulani living in Warchirashan and Fa'a Fulani settlements. Camp leaders were informed about the purpose and benefit of the study.

Information on age and sex were collected. Informed consent was obtained from heads of each of the families sampled in the camps using a translated version from English to Hausa language.

Ethical clearance for the study

Ethical clearance was obtained from the Adamawa State Ministry of Health and the camp leaders in the study area gave approval for this study.

Data Collection

Structured Questionnaire: A questionnaire was administered by trained interviewers in the local language (Hausa/Fulfulde) to collect data on socio-demographics, water sources, sanitation practices, and hygiene knowledge.

Collection of stool sample: A total of 220 stool samples were collected from the nomads in clean sterile vials. The nomads were randomly selected from the two fulani camps 110 for each of the study sites. The stool samples were preserved with 10% formalin and transferred to the Federal medical Center Hong parasitology laboratory for analysis.

Examination of the stool by Concentration method

The concentration method was used to concentrate helminths eggs in 1 g of the faeces. 1 g of stool sample was mixed with 10 ml of normal saline using an applicator stick to form a suspension. The suspension was filtered into a test-tube and centrifuged at 1,000 revolutions per minute for 1minute (1,000 rpm). The supernatant was discarded. About 3-4 ml of 10% formol solution was added to the deposit to form a homogenous suspension and the mixture was allowed to stand for 5 minutes on the length. A 3-4 ml of diethyl ether was added and shaken vigorously and allowed to stand for 2 minutes, it was then centrifuged at 1,000 revolutions per minute for 1 minute. The faecal debris from the slide of the tube was detached with the aid of a glass rod (spatula) and the supernatant discarded leaving the deposit at the bottom of the centrifuge tube. The deposit was tapped with finger to mix and using a Pasteur pipette, a drop of the deposit was applied on a microscope slide mixed with Lugol's iodine, covered with a cover slip and examined using x10 objective lens while the x40 objective lens was used for identification of eggs [World Health Organization (2023), Garcia, 2016].

Data analysis

The data in this study were processed using excel before they were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies, percentages) summarized the prevalence of infections and socio-demographic variables. The association between infection status and independent variables (e.g., age, sex, water source) was assessed using the Chi-square (χ^2) test. A p-value of < 0.05 was considered statistically significant. Associations between demographic attributes and parasite type were tested. The proportions obtained in the study were compared using chi-square test. The confidence level for the analysis was set at 95%, and level of significant difference at $p<0.05$.

RESULTS

As shown in Table 1, the prevalence of intestinal helminth infections among residents of the two Fulani settlements revealed similar patterns across the communities. In Warchirashan, 37 out of 110 individuals (33.6%) were infected, while Fa'a recorded 39 infections (35.5%), giving an overall prevalence of 34.5%. *Ascaris lumbricoides* and *Trichuris trichiura* were the most frequently identified parasites, with *A. lumbricoides* occurring in 11.8% of individuals in Warchirashan and 10.9% in Fa'a, and *T. trichiura* detected in 11.8% and 12.7% of residents, respectively. Hookworm infection was slightly higher in Warchirashan (10.9%) compared to Fa'a (7.3%), whereas *Schistosoma mansoni* was more prevalent in Fa'a (12.7%) than Warchirashan (10.0%). *Strongyloides stercoralis* occurred only in Warchirashan at a low rate (1.8%), while *Taenia solium* and *Enterobius vermicularis* were absent in both communities.

Patterns of infection types presented in Table 2 show that single-species infections were more common than polyparasitism in both settlements. In Warchirashan, 23 of the 37 infected individuals (62.2%) had single infections, while 14 (37.8%) had multiple infections. Similarly, in Fa'a, 22 out of 39 infected persons (56.4%) presented with single infections, and 13 (33.3%) exhibited polyparasitism. These findings indicate that although intestinal helminths remain prevalent in both Fulani settlements, the majority of infected individuals carried only one parasite species.

As presented in Figure 1, patterns of co-infection varied between the two Fulani settlements, with several notable parasite combinations observed. In Warchirashan, the most frequent co-infection pair was Hookworm–*T. trichiura*, recorded in four individuals, followed by *Ascaris*–*S. mansoni* and *S. mansoni*–*T. trichiura*, each occurring in three cases. Less frequent

combinations included *Ascaris*–*T. trichiura* and Hookworm–*S. mansoni*, with one case each, while no co-infection of *Ascaris* and Hookworm was observed. In Fa'a, the predominant combinations were Hookworm–*S. mansoni* (four cases) and *Ascaris*–*T. trichiura* (three cases). Other co-infections, including *Ascaris*–Hookworm, *Ascaris*–*S. mansoni*, Hookworm–*T. trichiura*, and *S. mansoni*–*T. trichiura*, occurred less frequently, with one or two cases each.

Table 1: Prevalence of intestinal helminth infections among residents in Fulani settlements

Parasite	Warchirashan (n=110)	Fa'a (n=110)	Total (n=220)
A. lumbricoides	13 (11.8)	12 (10.9)	25 (11.4)
T. trichiura	13 (11.8)	14 (12.7)	27 (12.3)
Hookworm	12 (10.9)	8 (7.3)	20 (9.1)
S. stercoralis	2 (1.8)	0 (0.0)	2 (0.9)
S. mansoni	11 (10.0)	14 (12.7)	25 (11.4)
T. solium	0 (0.0)	0 (0.0)	0 (0.0)
E. vermicularis	0 (0.0)	0 (0.0)	0 (0.0)
Total	37 (33.6)	39 (35.5)	76 (34.5)

Abbreviations: A. lumbricoides = *Ascaris lumbricoides*; T. trichiura = *Trichuris trichiura*; S. mansoni = *Schistosoma mansoni*; S. stercoralis = *Strongyloides stercoralis*; T. solium = *Taenia solium*

Table 2: Patterns of single and multiple (polyparasitic) intestinal helminth infections in Warchirashan and Fa'a Fulani settlements

Settlement	Total Positive	Single Infection (%)	Polyparasitism (%)
Warchirashan	37	23 (62.2)	14 (37.8)
Fa'a	39	22 (56.4)	13 (33.3)

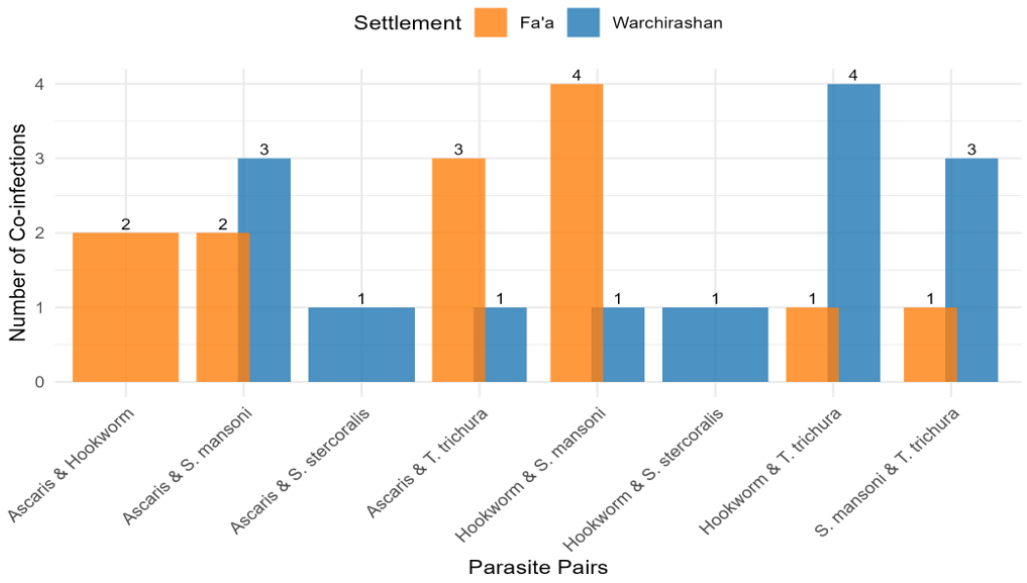


Figure 1:

As shown in Table 3, the sex-related prevalence of intestinal helminth infections revealed that males had a higher infection rate than females. Of the 139 males examined, 55 were infected, representing an infection rate of 39.57%, whereas females recorded 25.93% infection (21 out of 81 examined). Overall, 76 of the 220 participants were positive, giving a total prevalence of 34.55%. Although males showed a higher burden of infection compared to females, the difference was not statistically significant ($\chi^2 = 3.631$, df = 1, p = 0.0567), indicating that sex did not significantly influence infection status in the study population.

Table 3. Sex-specific prevalence of intestinal helminth infections among residents of Fulani settlements

Sex	Number examined	Number infected	Infection rate (%)
Male	**139**	**55**	**39.57%**
Female	81	21	25.93%
Total	220	76	34.55%

Statistical test: $\chi^2 = 3.631$, df = 1, p = 0.0567, p > 0.05 (not significant)

The age-specific prevalence of intestinal helminth infections in the two Fulani settlements is presented in Table 4a (Warchirashan) and Table 4b (Fa'a). In Warchirashan, the highest number of infections occurred among participants aged 8–17 years 13(48.2%), followed by the 18–30 years group 16(32.0%), 31–45 years 7(26.9%), and 46–60 years 1(14.3%). The most frequent parasites were *A. lumbricoides* 13(11.8%), hookworm 12(10.9%), and *T. trichiura* 13(11.8%), while *S. stercoralis* was least common 2(1.8%). No significant association was observed between age and overall infection ($\chi^2 = 4.56$, df = 3, p = 0.207).

In Fa'a, infections were most common among participants aged 8–17 years 14(56.0%), followed by 18–30 years 21(46.7%), 31–45 years 13(43.3%), and 46–60 years 4(40.0%). The predominant parasites were *A. lumbricoides* 16(14.6%), hookworm 18(16.4%), and *T. trichiura* 11(10.0%), while *S. stercoralis* remained the least frequent 4(3.6%). Age was not significantly associated with infection prevalence ($\chi^2 = 3.88$, df = 3, p = 0.275).

Table 4a. Age-Specific Prevalence of Intestinal Helminths in Warchirashan Fulani Settlement in Hong LGA

Age(years)	No. Examined	Total Positive (%)	A. lumbricoides (%)	Hookworm (%)	S. mansoni (%)	S. stercoralis (%)	T. trichiura (%)
8–17	27	13 (48.15)	4 (14.81)	5 (18.52)	2 (7.41)	2 (7.41)	5 (18.52)
18–30	50	16 (32.00)	4 (8.00)	6 (12.00)	7 (14.00)	0 (0.00)	6 (12.00)
31–45	26	7 (26.92)	4 (15.38)	1 (3.85)	2 (7.69)	0 (0.00)	2 (7.69)
46–60	7	1 (14.29)	1 (14.29)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Total	110	37 (33.64)	13 (11.82)	12 (10.91)	11 (10.00)	2 (1.82)	13 (11.82)

Chi-square (χ^2) for age vs total prevalence = 4.56, df = 3, p = 0.207 → no significant difference in prevalence across age groups.

Table 4b. Age-Specific Prevalence of Intestinal Helminths in Fa'a Fulani Settlement in Hong LGA

Age (years)	No. Examined	Positive (%)	A. lumbricoids (%)	Hookworm (%)	S. mansoni (%)	S. stercoralis (%)	T. trichiura (%)
8–17	25	14 (56.00)	5 (20.00)	4 (16.00)	2 (8.00)	1 (4.00)	2 (8.00)
18–30	45	21 (46.67)	6 (13.33)	8 (17.78)	5 (11.11)	2 (4.44)	4 (8.89)
31–45	30	13 (43.33)	4 (13.33)	5 (16.67)	3 (10.00)	1 (3.33)	3 (10.00)
46–60	10	4 (40.00)	1 (10.00)	1 (10.00)	1 (10.00)	0 (0.00)	2 (20.00)
Total	110	52 (47.27)	16 (14.55)	18 (16.36)	11 (10.00)	4 (3.64)	11 (10.00)

Chi-square (χ^2) for age vs total prevalence = 3.88, df = 3, p = 0.275 → no significant difference in prevalence across age groups.

The risk factors associated with intestinal helminth infections among residents of the two Fulani settlements are summarized in Tables 5a and 5b. In Warchirashan settlement, individuals using stream (11, 31.4%), river (14, 37.8%), well (9, 30.0%), or rainwater (2, 66.7%) as sources of drinking water had higher odds of infection compared to those using boreholes. Among sanitation systems, infections were more frequent among participants practicing open defecation (15, 31.2%) or bush defecation (9, 37.5%), while pit latrine users had slightly lower

infection prevalence (9, 34.6%). Regarding hygiene, individuals who never washed hands after defecation (6, 42.9%) or washed only sometimes (5, 17.9%) showed varying infection rates. Walking barefoot was associated with 18 (33.3%) infections, while water treatment practices appeared protective, with untreated water users having 23 (30.3%) infections. Significant associations ($p < 0.05$) were observed for water source and rainwater use, some sanitation practices, and handwashing frequency.

Similarly, in Fa'a settlement, higher prevalence was observed among residents using stream (12, 34.3%), river (15, 39.5%), well (10, 31.3%), or rainwater (2, 66.7%). Sanitation practices revealed infections among pit latrine users (8, 32.0%), open defecation (13, 31.0%), and bush defecation (10, 37.0%). Handwashing practices mirrored those in Warchirashan, with higher infection prevalence among those who never washed hands (6, 42.9%). Walking barefoot and untreated water use showed similar patterns, with 18 (33.3%) and 23 (30.3%) infections, respectively. Statistically significant risk factors ($p < 0.05$) included water source, rainwater use, bush defecation, and handwashing habits, while other factors such as walking barefoot and untreated water did not show significant associations.

Table 5a. Risk factors associated with intestinal helminth infections in Warchirashan Fulani settlement

Variables		**No. Positive (%)**	**No. Negative (%)**	**OR (95% CI)**	**p-value**
Source of water	Stream	11 (31.4)	24 (68.6)	1.833 (1.283 - 2.383)	< 0.05
	River	14 (37.8)	23 (62.2)	2.435 (1.704 - 3.165)	< 0.05
	Well	9 (30)	21 (70)	1.714 (1.2 - 2.229)	< 0.05
	Borehole	1 (20)	4 (80)	1	
	Rainwater	2 (66.7)	1 (33.3)	8 (5.6 - 10.4)	< 0.05
Sewage system	Pit latrine	9 (34.6)	17 (65.4)	1.059 (0.741 - 1.376)	< 0.05
	Open defecation	15 (31.2)	33 (68.8)	0.909 (0.636 - 1.182)	> 0.05
	Bush	9 (37.5)	15 (62.5)	1.2 (0.84 - 1.56)	< 0.05
	Water system	4 (33.3)	8 (66.7)	1	
Hand washing after defecation	Sometimes	5 (17.9)	23 (82.1)	0.351 (0.246 - 0.457)	> 0.05
	Always	26 (38.2)	42 (61.8)	1	

Variables		No. Positive (%)	No. Negative (%)	OR (95% CI)	p-value
	Never	6 (42.9)	8 (57.1)	1.212 (0.848 - 1.575)	< 0.05
Walking barefoot	Yes	18 (33.3)	36 (66.7)	0.974 (0.682 - 1.266)	> 0.05
	No	19 (33.9)	37 (66.1)	1	
Water treatment	Yes	14 (41.2)	20 (58.8)	1	
	No	23 (30.3)	53 (69.7)	0.62 (0.434 - 0.806)	> 0.05

Table 5b. Risk factors associated with intestinal helminth infections in Fa'a Fulani settlement

Variable	Category	Positive n (%)	Negative n (%)	OR (95% CI)	p-value
Source of water	Stream	12 (34.3)	23 (65.7)	1.87 (1.30–2.44)	<0.05
	River	15 (39.5)	23 (60.5)	2.12 (1.45–2.78)	<0.05
	Well	10 (31.3)	22 (68.7)	1.65 (1.12–2.19)	<0.05
	Borehole	1 (20.0)	4 (80.0)	1	–
	Rainwater	2 (66.7)	1 (33.3)	7.80 (5.20–10.4)	<0.05
Sanitation system	Pit latrine	8 (32.0)	17 (68.0)	1.06 (0.74–1.38)	<0.05
	Open defecation	13 (31.0)	29 (69.0)	0.92 (0.65–1.21)	>0.05
	Bush	10 (37.0)	17 (63.0)	1.25 (0.88–1.58)	<0.05
	Water system	4 (33.3)	8 (66.7)	1	–
Handwashing after defecation	Sometimes	4 (18.2)	18 (81.8)	0.35 (0.25–0.46)	>0.05
	Always	26 (38.2)	42 (61.8)	1	–
	Never	6 (42.9)	8 (57.1)	1.21 (0.85–1.57)	<0.05
Walking barefoot	Yes	18 (33.3)	36 (66.7)	0.97 (0.68–1.27)	>0.05
	No	19 (33.9)	37 (66.1)	1	–
Water treatment	Yes	14 (41.2)	20 (58.8)	1	–
	No	23 (30.3)	53 (69.7)	0.62 (0.43–0.81)	>0.05

DISCUSSION

Intestinal helminth infections, particularly soil-transmitted helminths (STHs), remain a significant public health concern in many rural and nomadic communities, despite being relatively preventable. The overall prevalence of intestinal helminths in this study was 34.5% among Fulani settlements in Adamawa State, Nigeria. This finding is comparable to recent

reports from other Nigerian settings, including 38.4% among children attending a tertiary health facility in Imo State (Chidi *et al.*, 2023), 29.1% in a rural farming community in Anambra State (Ahanonu *et al.*, 2023), and 30.5% in primary school children in Akwa Ibom State (Agbroko *et al.*, 2025). Furthermore, a systematic review of northern Nigeria reported a pooled STH prevalence of 37.1% (Rabiu *et al.*, 2025), indicating that helminth infections remain endemic despite ongoing control efforts.

Among the parasites identified, *Ascaris lumbricoides*, *Trichuris trichiura*, and *Schistosoma mansoni* were the most prevalent species, while *Strongyloides stercoralis* was detected at low frequency, and *Taenia solium* and *Enterobius vermicularis* were absent. The predominance of *A. lumbricoides* and *T. trichiura* aligns with other recent studies in Nigeria (Ahanonu *et al.*, 2023; Chidi *et al.*, 2023), reflecting environmental conditions conducive to transmission, such as poor sanitation and soil contamination. The absence of *T. solium* may be attributed to dietary habits of nomadic Fulani, who rarely consume pork, while the low prevalence of *S. stercoralis* may reflect both the limited exposure and traditional dietary practices, including high milk consumption, which has been shown to influence susceptibility to certain parasites (Onifade *et al.*, 2017).

Age-specific analysis indicated the highest prevalence among young adults aged 18–30 years, which may be linked to occupational exposure. This age group is typically responsible for herding livestock and spending prolonged periods in outdoor environments where infective stages of parasites are present, such as contaminated water sources and soil (Ahanonu *et al.*, 2023; Agbroko *et al.*, 2025). Children and adolescents also exhibited notable infection rates, likely due to playing in contaminated environments, geophagia, and limited hygiene practices (Chidi *et al.*, 2023).

Although males exhibited higher infection rates than females (39.6% vs 25.9%), this difference was not statistically significant ($p>0.05$). This trend may be explained by behavioral and occupational differences, where males are more likely to engage in outdoor activities, such as cattle herding and farming, increasing their exposure to contaminated soil and water (Onifade *et al.*, 2017).

Patterns of polyparasitism were common, with 37.8% of infected individuals in Warchirashan and 33.3% in Fa'a harboring multiple helminth species. Co-infections involving *A. lumbricoides*, *T. trichiura*, and *S. mansoni* were frequently observed, suggesting overlapping transmission routes and shared environmental risk factors. These findings highlight the need

for integrated control strategies targeting multiple parasites simultaneously, rather than species-specific interventions alone (Rabiu *et al.*, 2025).

Environmental and behavioral factors, including reliance on surface water sources, open defecation, inconsistent handwashing, and lack of water treatment, were associated with increased infection risk. Similar associations have been reported in recent studies from Nigeria and other endemic regions, emphasizing the critical role of improved sanitation and hygiene education in reducing helminth transmission (Ahanonu *et al.*, 2023; Chidi *et al.*, 2023).

Overall, the study provides contemporary baseline data on intestinal helminth infections among nomadic Fulani communities in Hong Local Government of Adamawa State, Nigeria. These findings underscore the urgent need for comprehensive, community-based control programs that include health education, regular deworming, improved sanitation, and safe water access, not only for children but across all age groups in nomadic populations (Agbroko *et al.*, 2025; Rabiu *et al.*, 2025).

CONCLUSION

The study demonstrates a moderate prevalence of intestinal helminth infections among nomadic Fulani communities in Adamawa State, with *Ascaris lumbricoides*, *Trichuris trichiura*, and *Schistosoma mansoni* being the most common parasites. Infections were influenced by environmental and behavioral factors, including source of water, sanitation practices, and outdoor occupational activities. Although prevalence did not differ significantly across age groups or sexes, the findings highlight the ongoing risk of helminth transmission in these populations. Targeted interventions, including improved sanitation, safe water access, and health education, are essential to reduce infection rates and improve the overall health of nomadic communities.

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