Epidemiological Characteristics and Prevalence of Gastrointestinal Parasites in Small Ruminants in Toro Local Government Area of Bauchi State, Nigeria

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ABSTRACT

Gastrointestinal (GI) parasites are a major constraint to small ruminant production, causing poor growth, reduced productivity, and economic losses. This study investigated the prevalence and distribution of GI parasites in sheep and goats in Toro Local Government Area (LGA), Bauchi State, Nigeria. A total of 210 small ruminants (101 sheep and 109 goats) were randomly sampled across three districts (Jama'a, Lame, and Toro). Faecal samples were examined using flotation and sedimentation techniques, and data were analyzed in RStudio using Chi-square and Fisher's exact tests, with significance set at $p < 0.05$.

The overall prevalence of GI parasites was 82.9% (95% CI: 75.4–83.9). Goats (68.8%) were significantly more infected than sheep (43.6%) ($p < 0.001$). Males (64.7%) had higher infection rates than females (52.8%) ($p = 0.004$). District-level prevalence varied, with Toro showing the highest burden (73.8%) compared to Lame (56.2%) and Jama'a (41.7%) ($p < 0.001$). Age was not significantly associated with infection ($p = 0.15$). The most common parasites identified were Coccidia spp. (18.6%), Haemonchus spp. (12.4%), Fasciola spp. (16.2%), and Paramphistomum spp. (9.0%). The flotation method detected more parasites (87.1%) than sedimentation (25.2%).

This study reveals that GI parasites remain highly prevalent among small ruminants in Toro LGA, with species, sex, and district significantly influencing infection rates. The high burden underscores the need for integrated control strategies, including strategic deworming, improved grazing management, snail control in fascioliasis endemic areas, and farmer education. These interventions are critical to improving small ruminant health, productivity, and rural livelihoods in Nigeria.

Keywords: Gastrointestinal parasites; Small ruminants; Prevalence; Epidemiology; Nigeria; Toro LGA

INTRODUCTION

Sheep and goats (small ruminants) are vital to rural livelihoods across northern Nigeria, including Bauchi State. They serve as primary sources of income, protein, savings, and social capital, particularly for smallholder and

pastoralist systems. However, their productivity is significantly undermined by parasitic infections, especially gastrointestinal (GI) parasites, which cause weight loss, anemia, morbidity, and economic losses (1).

A high pooled prevalence (58%) of GI helminth infections in small ruminants across Nigeria (2011–2019) underscores the endemic nature of these parasites. Seasonal trends with prevalence often peaking in dry or earlypostrainy periods suggest climate-driven epidemiological cycles (2-4).

A study in Bauchi Local Government Area (2021) analyzed fecal samples from 100 goats. The overall prevalence was 78%, with young goats showing 100% infection and adult goats 74.1%. Males were more affected (93.3%) than females (75.3%). Key parasites identified included Trichostrongylus spp., Ostertagia spp., Haemonchus contortus, and Coccidia spp. Mixed infections occurred in 30% of cases (1).

In November 2024 survey examined 50 sheep and 50 goats at Bauchi Central Abattoir. Overall, prevalence was 47.5% in goats and 52.5% in sheep. Detected parasites included Strongyloides (34.7%), Fasciola spp. (15.3%), Oesophagostomum columbianum (12.2%), Cryptosporidium (9.2%), Eimeria spp., and various helminths such as Dicrocoelium, Trichuris, and Haemonchus. Females had significantly higher prevalence (75% vs. 25%), and younger animals also had higher rates than adults (5). In Gadau, a study under traditional management reported an overall helminth prevalence of 42.7% among goats and sheep. The infection varied by age, sex, and species, with goats generally more affected than sheep (3, 4).

Jalingo Abattoir, Taraba State About 42.7% of 914 small ruminant samples were positive, with Haemonchus, Oesophagostomum, Strongyloides, and Ostertagia identified. Adults were more infected than younger animals (6). In Shendam, Plateau State: Among 600 samples (sheep and goats), overall prevalence was 78.8% with goats (90.8%) significantly more infected than sheep (71.2%). Parasite genera included Haemonchus, Trichuris, Oesophagostomum, Fasciola, and Coccidia (7).

Toro Local Government Area lies within the northern Guinea savanna, characterized by a customary single rainy season (roughly April–October, peaking in August) followed by a prolonged dry season. This climate facilitates selective survival and transmission of infective larvae, with seasonal peaks likely during or just after the rains when pasture contamination is highest (2, 3). Though no published data exist specifically for Toro, the patterns observed in broader Bauchi and neighbouring regions suggest a similar high endemic burden, especially among young stock and under poor management regimes.

Haemonchus contortus is a highly prolific and hematophagous nematode, along with other strongyle-type parasites such as Oesophagostomum, Tricostrongylus, and Trichuris species, are among the principal causes of gastroenteritis, anemia, weight loss, and reduced productivity in small ruminants. These infections typically reach their peak during the rainy season, when warm and humid environmental conditions favour parasite transmission (8, 15). Trematodes such as Fasciola and Dicrocoelium spp. Compromise liver and bile duct function, leading to anemia, impaired growth, reduced fertility, and occasionally death (5, 9). Similarly, Paramphistomum spp. (amphistomes) may cause severe enteritis during their immature stages, resulting in significant mortality under heavy infections (9). Protozoan parasites, including Eimeria and Cryptosporidium, are commonly associated with diarrhoea, stunted growth, and high morbidity in young animals, and were frequently detected in samples collected from Bauchi central abattoir (5).

Although several studies have been conducted in neighboring Local Government Areas (LGAs) such as Jos North, Jos East, and Lere, as well as in regional abattoirs, there remains a paucity of on-farm and longitudinal data on gastrointestinal parasites prevalence in Toro LGA. A focused epidemiological investigation in this area is therefore warranted to fill this knowledge gap and generate evidence-based insights for improved parasites control, extension services, and livestock health policies. This study aims to determine the prevalence, species composition, and infection intensity of gastrointestinal parasites among small ruminants in Toro LGA, thereby providing a foundation for the development of more targeted and sustainable intervention strategies.

MATERIALS AND METHOD

Study Area

Toro is a local Government Area of Bauchi state, Nigeria. Toro local government headquarter is in the town of Toro. The local government has three (3) district i.e Toro, Jama'a and lame district. The local government is the largest local government in Nigeria and West African in particular. It has an area of 6,9322km and a population of 350,404 at the census 2006. Toro local government is rich in culture and has diverse ethnic group such as Duguza, Fulani and kaiwari among other (10).

Sample Collection

Approximately 5g of faeces were aseptically collected per rectum from sheep (n = 101) and goats (n = 109) across households in Toro L.G.A. between April and November 2024. Animals were selected by systematic random sampling, and samples were labelled with species, sex, age, and districts. A total of 210 samples were obtained and transported to the Parasitology Laboratory, National Veterinary Research Institute (NVRI), Vom, for analysis.

Sample Processing

Faecal samples were processed using both flotation and sedimentation techniques. Gastrointestinal nematodes were identified through the standard flotation method described by Charles (11), with sodium chloride (NaCl) employed as the flotation solution. Trematode eggs were detected using the sedimentation technique, following the procedure outlined by Bogale (12).

Statistical Analysis

Data were coded into appropriate variables and entered into Microsoft Excel for management. Statistical analyses were performed using RStudio (13). Prevalence was estimated as the proportion of positive samples relative to the total number of samples examined, expressed as a percentage. Differences in prevalence across species, age groups, sex, and districts were assessed using the Chi-square (χ^2) test or Fisher's exact test where appropriate. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1: Epidemiological characteristics of small ruminants sampled in Toro LGA, Bauchi State (n = 210)

Characteristic	Category	Frequency (n)	Percentage (%)
Age	Adult	135	64.3
	Young	75	35.7
Species	Sheep	101	48.1
	Goat	109	51.9
District	Jama'a	72	34.3
	Lame	73	34.8
	Toro	65	31.0
Sex	Female	142	67.6
	Male	68	32.4

A total of 210 small ruminants (sheep and goats) were sampled across three districts of Toro LGA. Adults constituted the majority of the animals examined (64.3%, n = 135), while young animals accounted for 35.7% (n = 75). Species distribution showed that 48.1% (n = 101) were sheep and 51.9% (n = 109) were goats. The animals were sampled from Jama'a district (34.3%, n = 72), Lame district (34.8%, n = 73), and Toro district (31.0%, n = 65). With respect to sex, females represented 67.6% (n = 142) of the sampled animals, while males accounted for 32.4% (n = 68) (Table 1).

Table 2: The prevalence of gastrointestinal parasites in small ruminants based on host and demographic characteristics

Characteristics animals		No of examined samples	No of positive (%)	prevalence	P-value
Species	Sheep	101	44	43.6	<0.001
	Goat	109	75	68.8	
Age	Adult	135	80	59.3	0.15
	Young	75	39	52.0	
District	Jama'a	72	30	41.7	<0.001
	Lame	73	41	56.2	
	Toro	65	48	73.8	
Sex	Female	142	75	52.8	0.004
	Male	68	44	64.7	

The prevalence of gastrointestinal parasites in small ruminants based on host and demographic characteristics is presented in **Table 2**. Goats had a significantly higher prevalence (68.8%) compared to sheep (43.6%) ($p < 0.001$). Adults (59.3%) and young animals (52.0%) showed no significant difference in prevalence ($p = 0.15$).

Across districts, prevalence varied significantly, ranging from 41.7% in Jama'a, 56.2% in Lame, to 73.8% in Toro ($p < 0.001$). By sex, males recorded a higher prevalence (64.7%) than females (52.8%), and this difference was statistically significant ($p < 0.004$).

Table 3: Distribution of the Parasites based on Diagnostic Methods

Nematode	No of Parasite	Percentage (%)	Trematode	No of Parasite	Percentage (%)
Haemonchus spp	26	12.4	Fasciola spp	34	16.2
Oesophagostomum spp	20	9.5	NPF	157	74.8
Trichostrongylus spp	18	8.6	Paramphistomum spp	19	9.0
Coccidia spp	39	18.6			
Moniezia spp	2	1.0			
NPF	15	7.1			
Strongyloides spp	14	6.7			
Bunostomum spp	2	1.0			
Floatation			**Sedimentation**		

*NPF-no parasite found

Table 3 summarizes the distribution of gastrointestinal parasites detected in sheep and goats using both floatation and sedimentation techniques. Among the nematodes, *Coccidia* spp. (18.6%) and *Haemonchus* spp. (12.4%) were the most frequently detected, followed by *Oesophagostomum* spp. (9.5%), *Trichostrongylus* spp. (8.6%), and *Strongyloides* spp. (6.7%). *Moniezia* spp. and *Bunostomum* spp. were detected at a much lower prevalence (1.0% each). For trematodes, *Fasciola* spp. was the most prevalent (16.2%), followed by *Paramphistomum* spp. (9.0%). A large proportion of samples (74.8%) tested showed no trematode infection (NPF).

Table 4: Prevalence of gastrointestinal parasites based on diagnostic methods

Method	No of Positive	Prevalence (%)	95% CI
Floatation	121	57.6	81.6 – 91.2
Sedimentation	53	25.2	19.6 – 31.8
Overall (both)	**174**	**82.9**	**75.4 – 83.9**

Table 4 presents the prevalence of gastrointestinal parasites detected by the two diagnostic techniques employed. Using the flotation method, 121 animals tested positive, giving a prevalence of 57.6% (95% CI: 51.6–61.2). The sedimentation method identified 53 positive cases, corresponding to a prevalence of 25.2% (95% CI: 19.6–31.8). When results from both methods were combined, the overall prevalence was 82.9% (95% CI: 75.4–83.9).

DISCUSSION

This study revealed a very high overall prevalence (82.9%) of gastrointestinal parasites among small ruminants in Toro LGA, Bauchi State, confirming that parasitic infections remain a major constraint to small ruminant production in northern Nigeria. Goats (51.9%) were significantly more affected than sheep (48.1%). This result aligns with previous reports indicating that the browsing and forage behaviour of goats predisposes them to greater exposure to infective larvae present on shrubs and ground herbage (1, 7).

Age did not significantly influence prevalence, suggesting uniform exposure across all age groups under communal grazing systems, although some studies reported higher susceptibility in younger animals (4). However, the absence of a clear age effect at the analysis level suggests mixed patterns across parasite taxa and reinforces the need for taxa-specific analysis.

Statistical analysis of the data on the prevalence of gastrointestinal parasites among sex groups shows that there was significance difference ($p < 0.004$). Males (64.7%) had higher prevalence rates than females (52.8%), which may reflect lower immunity or management factors such as earlier sale or stress due to breeding activities (5).

District was found to be significantly associated with the prevalence of gastrointestinal parasites ($p < 0.001$). Marked geographical heterogeneity was evident: animals in Toro district showed the highest prevalence (73.8%), highlighting that local ecological and management conditions strongly influence infection risk. These results emphasize that control strategies must be tailored to local settings, what works in one district may not suffice in another, even within the same region or country.

Similar spatial variation in parasite prevalence has been documented in other studies in Nigeria, reinforcing that heterogeneity is common rather than exceptional (2). In a meta-analysis of Nigerian ruminants, Banwo *et al*. (2025) also reported substantial regional differences in prevalence rates, with the North-Central zone showing high pooled prevalence (74%) (16). other studies highlighted wide variations across states, ranges from 10.9 % to 95 % underlining wide intra-country heterogeneity (15, 2). Karshima and Karshima (2020) also observed district-level variability linked to environment and management (8). Comparable findings were reported in Ethiopia, where district-level variation was linked to altitude, grazing patterns, and moisture (8).

Thus, our findings in Toro LGA reflect a broader pattern. However, parasite prevalence often exhibits strong spatial structure both within and between countries. This adds weight to the view that effective parasitic control must incorporate geographic risk mapping, ecological stratification, and management practices as integral components of intervention design.

Parasite distribution pattern highlighted *Coccidia* spp. and strongyles (*Haemonchus* spp. in particular) as dominant, consistent with findings across northern Nigeria (1, 7). The high detection of *Fasciola* spp. indicates ongoing transmission of trematodes in irrigated and swampy areas, supported by the presence of suitable snail intermediate hosts (5, 9).

The flotation method demonstrated superior sensitivity compared to sedimentation, reflecting its efficiency in detecting light nematode eggs and coccidia oocysts, whereas sedimentation remains more suited for heavier trematode eggs. This methodological difference aligns with previous diagnostic evaluations (14). The practical corollary is that prevalence and burden estimates drawn from a single technique will under or over represent particular parasite groups unless the diagnostic limitations are explicitly acknowledged (14).

Overall, the study underscores the endemic nature and diversity of gastrointestinal parasites in small ruminants in Toro LGA. Effective control requires integrated approaches, including strategic anthelmintic treatment,

improved grazing management, and snail control in Fascioliasis-endemic areas, and farmer education on sustainable parasite control practices.

CONCLUSION

This study underscores the high burden of gastrointestinal parasites in small ruminants in northern Nigeria, posing a significant threat to animal health and productivity. The findings are highly relevant because sheep and goats are vital to rural households as sources of income, nutrition, and livelihood security. By providing current epidemiological data, the study offers critical evidence to guide veterinary interventions, inform policymakers, and support sustainable parasite control programs. Effective management will not only improve small ruminant productivity but also enhance food security and strengthen rural livelihoods in Nigeria.

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