




Epidemiological studies of gastrointestinal helminths affecting cattle in Bogoro Local Government Areas of Bauchi State, North-east Nigeria

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Abstract	Article History
<p>Cattle are Nigeria's most abundant type of livestock, accounting for 5.2 percent of the country's GDP. Feed shortage, limited knowledge of farmers in livestock production, nutrition, breeding, and parasitic disease are the various factors that decrease cattle production. Most of these parasitic infections are zoonotic, putting people's health at risk. This research aims to provide epidemiological data on the prevalence of cattle gastrointestinal parasites in the study area. A cross-sectional study was conducted from April to November 2021 to determine the prevalence of gastrointestinal helminth parasites affecting cattle in Bogoro LGA. A standard coprological method was used to analyze 200 faecal samples from cattle for the presence of gastrointestinal helminth eggs. All collected data were analyzed using SPSS version 24. A chi-square and logistic regression analysis were performed to evaluate the relationships between the dependent and independent variables. A total of 58 (29.0%) of the cattle sampled tested positive for one or more gastrointestinal helminth infections. <i>Trichostrongylus</i> spp. (10.0%) and <i>Oesophagostomum</i> spp. (3.0%) were most prevalent among the nematodes, while <i>Fasciola</i> spp (4.5%) and <i>Schistosoma</i> spp. (3.5%) were the most prevalent among the trematode. <i>Moniezia</i> spp. (1.0%) was the only cestode detected. The differences in the prevalence of gastrointestinal helminth infections to sex, age, and breed do not vary significantly. There is a statistically significant difference in the prevalence of gastrointestinal helminth infections in the class of helminth parasites ($\chi^2 = 31.29$, $df = 2$, $p = 0.001$). The binary logistic regression analysis shows that the cattle are more likely to be infected with nematodes than cestodes [COR (95% CI): 21.00 (4.98-88.62)]. Considering the high percentage of gastrointestinal helminth infections, there is a need for proper control and preventative methods, such as strategic deworming of cattle and sound management practices, are required to reduce the parasitic burden and increase productivity.</p>	<p>Received: 27/04/2022 Accepted: 13/09/2022 Published: 16/09/2022</p> <p>Keywords Epidemiological; Gastrointestinal helminths; Parasites; Cattle; Bogoro</p> <p>License: CC BY 4.0*</p>  <p>Open Access Article</p>
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1.0 Introduction

The Nigerian livestock industry is a vital sub-sector of the economy, estimated to be the tone of USD 6 billion, and cattle production contributes a significant chunk (Akanke *et al.*, 2010; Ola-Fadunsin *et al.*, 2020). In Nigeria, the livestock sector contributes 5.2% of the gross domestic product (GDP), and cattle

are the most common type of livestock. Their numbers are estimated to be more than 19 million, and their productions contribute 50% of the total meat and are primarily found in the country's northern regions (Lawal-Adebowale, 2012; Adedipe *et al.*, 2014). Cattle production in Nigeria provides essential sources of animal protein, raw materials, income, farm power,

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employment, and organic manure, and the benefits cannot be overstated (Umar *et al.*, 2021). Cattle ownership reflects the wealth and social status in some parts of Nigeria. However, cattle production productivity and income have declined due to the feed shortage, limited knowledge of farmers in livestock production, nutrition, breeding, and parasitic infections.

Parasitic infections, particularly gastrointestinal parasites, are a severe health threat to livestock, and their associated morbidity, mortality, treatment, and control costs harm livestock production. Furthermore, most of these parasitic infections are zoonotic, posing a risk to public health. Factors such as climate, pasture management, the number of infective eggs and larvae in the environment, the presence of intermediate hosts, grazing habits, and nutritional status all influence the incidence and severity of gastrointestinal parasites. Gastrointestinal parasites are widely distributed, and prevalence studies have been conducted in Nigeria's various geographical regions. However, there is a scarcity of data on cattle gastrointestinal parasites in Northeastern Nigeria. Good management and knowledge of the prevalence of gastrointestinal parasites are essential to prevent and control parasitic infections, especially zoonotic parasites. As a result, the current research was carried out in Bogoro Local Government Areas of Bauchi State in Northeastern Nigeria to determine the prevalence of gastrointestinal parasites in cattle. The finding of this study will provide baseline epidemiological data on this group of parasites and other economically and zoonotically important livestock diseases, which is critical in cattle management for increased production in Nigeria.

2.0 Materials and Methods

2.1 Study Area

The research was conducted in the Bogoro Local Government Area of Bauchi State, northeastern Nigeria. The cross-section study was conducted between June 2021 and November 2021 to determine the prevalence of gastrointestinal parasites in cattle.

2.2 Sample Size

The sample size of the present study was calculated based on the Cochran formula (Naing *et al.*, 2006), with an estimated prevalence of 6.7 % (Karshima *et al.*, 2016).

$$n = \frac{Z^2 P (1-P)}{d^2}$$

$Z = 1.96$, $p = 6.7\%$ (0.067) is the prevalence expected based on a previous study, d is the precision or margin of the error (5%, $d=0.05$), and n is the sample size. This gave us a minimum sample of 96.1. However, the sample size calculated was adjusted to 200 as the baseline sample size of our study to avoid bias.

2.3 Sample Collection

The cattle for the study were chosen using a random sampling technique. The age of the cattle was

estimated as reported by Olaogun and Lasisi (2015). About 5g of faecal samples were collected from the rectum of each cattle and placed directly into clean polyethene disposal bags labelled appropriately. The samples were placed in an ice box and transferred to the Department of Biological Sciences Laboratory, Bauchi State University Gadau, Nigeria, for analysis.

2.4 Sample Analysis

Flotation and sedimentation procedures for determining the presence of gastrointestinal helminth eggs in all the faecal samples were performed as described by Cheesbrough (2009). Cestodes and nematode eggs were detected using floatation methods because they are lighter. On the other hand, the sedimentation approach was used to detect trematodes eggs since they are heavier. The Faecal samples containing egg(s) of gastrointestinal helminth parasites were recorded as positive, while those without eggs of gastrointestinal helminth parasites were considered negative (Soulsby, 1982).

2.5 Data Analysis

All the information gathered during the study was entered into a Microsoft Excel spreadsheet. All data were imported to the Statistical Package for the Social Sciences (SPSS) for Windows version 24.0 for statistical analysis. Descriptive statistics were used with percentages in tables. The prevalence was determined by dividing the number of cattle with helminth egg(s)/adult helminth(s) by the number of cattle sampled. To determine the relationship between each risk factor and the presence or absence of adult helminth(s) and helminth egg, the univariate analysis (Chi-square) test and odds ratios (ORs) with a 95 percent confidence interval (CI) were used. The ORs were calculated to a reference category, as indicated in the tables. The values were statistically different when $p < 0.05$.

3.0 Results

A total of 58 (29.0 %) cattle sampled were infected with one or more helminth species. Ten helminth species were recorded, including five gastrointestinal nematodes, four trematodes, and only one cestode. *Trichostrongylus* spp recorded 20 (10.0%) being the most common. *Nematodirus* spp. and *Moniezia* spp recorded 2 (1.00%) and were the least common. *Oesophagostomum* spp., *Haemonchus* spp., and *Enterobius vanicularis* were shown to have prevalences of 6.00 %, 4.00 %, and 3.00 %, respectively, in the phylum Nematoda. In the Trematoda and Cestoda groups, *Fasciola* spp and *Moniezia* spp. were the most common (Table 1).

The abundance of types of heminth parasites and their distribution according to Age, sex, and breed of the cattle are shown in Table 2. Out of the total number of gastrointestinal helminths parasites observed in the present study, nematodes have the highest prevalence

(17.5%), followed by the trematodes (14.0%). Cestodes have the least prevalence (1.0%). However, the difference in the prevalence of gastrointestinal helminth infections with respect to the class of helminth parasites was statistically significant ($\chi^2 = 31.29$, $df = 2$, $p = 0.001$) Table 2. The binary logistic regression analysis shows that the cattle are more likely to be infected with nematodes than cestodes [COR (95% CI): 21.00 (4.98-88.62)].

The highest prevalence of gastrointestinal helminth infection was recorded among the 4-6 years age group (35.1%), followed by the 1-3 years age group (25.5%). Meanwhile, the seven years and above group has the least infection rate (25.0%). However, the result showed no statistically significant difference in the prevalence of gastrointestinal helminth infection within the age groups ($\chi^2 = 2.15$, $df = 2$, $p = 0.34$).

Regarding sex, the result shows that the prevalence of gastrointestinal helminth infection was higher among females (30.0%) than males (28.3%). However, the differences in the prevalence of gastrointestinal helminth infection to sex were not statistically significant ($\chi^2 = 0.06$, $df = 1$, $p = 0.79$).

The white Fulani had the highest gastrointestinal helminth infection rate of 30.4% than the Sokoto Gudali, which had a 15.8% rate. However, the differences in the prevalence of gastrointestinal helminth infection to breed were not statistically significant ($\chi^2 = 1.78$, $df = 1$, $p = 0.18$). The binary logistic regression analysis shows that the cattle are more likely to be infected with nematodes than cestodes [COR (95% CI): 21.00 (4.98-88.62)] (Table 2).

Table 1: Species distribution of gastrointestinal helminth among cattle

Helminth Parasite Class	Helminth Parasite Species	Number infected	Prevalence (%)
Nematodes	<i>Trichostrongylus</i> spp.	20	10.00
	<i>Oesophagostomum</i> spp.	6	3.00
	<i>Haemonchus</i> spp.	4	2.00
	<i>Enterobius vamicularis</i>	3	1.50
	<i>Nematodirus</i> spp.	2	1.00
Trematodes	<i>Fasciola</i> spp.	9	4.50
	<i>Schistosoma</i> spp.	7	3.50
	<i>Paragonimus</i> spp.	6	3.00
	<i>Dicrocoelium</i> spp.	6	3.00
Cestodes	<i>Moniezia</i> spp.	2	1.00

Table 2: The abundance of types of helminth parasites and their distribution according to age, sex, and breed of cattle

Variables	No examine	Positive (%)	χ^2	Logistic regression			P value
				OR	Lower (95% CI)	Upper	
Type of helminth							
Nematodes	200	35 (17.5)	31.29	21.00	4.98	88.62	0.001
Trematodes	200	28 (14.0)		16.12	3.78	68.64	0.001
Cestodes	200	2 (1.0)		1	1	1	1
Age							
1-3	106	27 (25.5)	2.15	1.03	0.34	3.09	0.96
4-6	74	26 (35.1)		1.63	0.53	4.98	0.39
7 and above	20	5 (25.0)		1	1	1	1
Sex							
Male	120	34 (28.3)	0.06	0.92	0.49	1.72	0.79
Female	80	24 (30.0)					
Breed							
Sokoto Gudali	19	3 (15.8)					
White Fulani	181	55 (30.4)	1.78	2.33	0.65	8.32	0.18

4.0 Discussion

Helminth infections in cattle are well-acknowledged as a critical source of livestock production constraints. Infections are usually asymptomatic yet can cause large financial losses due to animal death, production, and reproductivity. The findings from the present study showed that 29.0% of the cattle examined were infested with one or more parasitic helminth species, thus, providing helpful information on the burden of helminths among cattle in Nigeria. The result shows that gastrointestinal helminth parasites are endemic in cattle in the Bogoro Local Government Areas of Bauchi State, Northeastern Nigeria. This is within the range of 1.72% to 82.7% for gastrointestinal helminths established in Nigeria (Agbajelola *et al.*, 2015; Akpabio, 2014; Karshima *et al.*, 2016), and 50.50% to 74.0% in other regions of the world (Bisimwa *et al.*, 2018; Leon *et al.*, 2019). The differences in our findings from other reports could be due to differences in sample size, sample selection, cattle breed(s), climatic conditions, management practices, cattle grazing habits, farmer level of education, availability of intermediate hosts, and study period (Ola-Fadunsin *et al.*, 2020; Umar *et al.*, 2021).

Among the three classes of helminth parasites detected in the present study, nematodes account for the highest burden of the parasites, 17.5%. This is followed by trematodes and cestodes, accounting for 14.0% and 1.0%, respectively. However, the logistic regression analysis indicates that cattle in the study area are almost twenty-one times more likely to be affected by nematodes than cestodes [COR (95% CI): 21.00 (4.98-88.62)]. High levels of nematode have been found to be the most common helminth infecting cattle in Nigeria (Nnabuife *et al.*, 2013; Ola-Fadunsin *et al.*, 2020; Umar *et al.*, 2021) and other parts of the world (Bisimwa *et al.*, 2018; Telila *et al.*, 2014). Infections caused by nematodes significantly impact livestock production because they reduce milk, meat, wool, hide products, and working animal stamina (Ekong *et al.*, 2012; Nwosu *et al.*, 2007). They also result in decreased production potentials such as reduced growth rate, weight loss in young growing calves, and late maturity of the animals (Ola-Fadunsin *et al.*, 2020). The present study showed that the most common gastrointestinal nematodes species found was *Trichostrongylus* spp., followed by *Oesophagostomum* spp. and *Haemonchus* spp, which have a prevalence of 30.3, 9.1, and 6.1, respectively. This study's high incidence of these gastrointestinal nematodes could be linked to the helminths' direct life cycle, which requires no intermediate host. So also, nematodes with free-living stages can remain on pasture all year, allowing for infections at any time. *Trichostrongylus* spp. can resist harsher seasons, making it easier for them to survive and reinfect throughout the year (Silva *et al.*, 2012).

This study also revealed that trematodes (*Fasciola* spp., *Schistosoma* spp., *Paragonimus* spp., and *Dicrocoelium* spp.) were the most abundant gastrointestinal parasites. This agrees with the findings of Umar *et al.* (2021) and Adedipe *et al.* (2014), who also reported some of these trematodes in their studies. The logistic regression analysis of the present study indicates that cattle in the study area are almost sixteen times more likely to be affected by trematodes than cestodes [COR (95% CI): 16.12 (3.78-68.64)]. The most common trematode species in this investigation was the *Fasciola* spp. The result of this study is similar to the findings of other studies undertaken in Nigeria (Lemy and Egwunyenga, 2018; Ola-Fadunsin *et al.*, 2020) and other countries of the world (León *et al.*, 2019; Telila *et al.*, 2014), which identified *Fasciola* spp. as the most prevalent gastrointestinal helminth trematodes affecting cattle.

The current study's high prevalence of *Fasciola* spp. is lower than that reported by Umar *et al.* (2021) and Ola-Fadunsin *et al.* (2020) in northeastern and southwestern Nigeria, respectively. Infections with *Fasciola* species cause severe liver flukes in cattle, resulting in weight loss, decreased milk output, reduced reproductive rates, and perhaps death (Thanasuwan *et al.*, 2021). Researchers have discovered that fluke density is influenced by the population of intermediary snail hosts, such as *Bulinus* spp. Compared to the other trematodes detected in this study, the prevalence rates of *Paragonimus* spp. and *Dicrocoelium* spp. were low. This could be because the grazing region is unsuitable for the proliferation of intermediate snail hosts, which are essential in transmitting snail-borne trematode infection. The variances seen among studies in trematode prevalence, in general, may be related to changes in climatic-ecological conditions among research sites, the difference in rainfall between study years, variability in study seasons, and difference in animal management techniques.

Regarding cestodes, the total prevalence of *Moniezia* spp. identified in our study was substantially lower than that reported by Adedipe *et al.* (2014) and Umar *et al.* (2021) in Nigeria at 2.1% and 4.2%, respectively. *Moniezia* spp. has been identified as the most common cestode afflicting cattle in several studies conducted in Nigeria (Ola-Fadunsin *et al.*, 2020) and other countries (León *et al.*, 2019; Telila *et al.*, 2014). The climatic conditions are unfavourable for the survival of their intermediate host; the oribatid mite may explain the low incidence of *Moniezia* spp. in the current study. Female cattle (30.0%) had a higher overall prevalence of gastrointestinal helminth parasites than males (28.3%). However, the result of the findings showed no statistically significant difference. This indicates that male and female animals are equally susceptible to gastrointestinal helminth infection. Male and female

cattle in the local context in Nigeria are subjected to poor feeding and veterinary treatment, conditions that account for similar vulnerability to helminth infections, is one crucial factor that would have accounted for this. However, this finding is contrary to that of Bisimwa *et al.* (2018) in Congo's South Kivu Province and Umar *et al.* (2018) in Nigeria's Bauchi State, which found that male cattle were more likely to be infected with helminths than females. The rationale was that male animals were more aggressive when feeding and hence more likely to pick up helminth ova on the grass.

Furthermore, male domestic ungulates are more susceptible to gastrointestinal tract parasite infections than females due to hormones that suppress immune processes, allowing parasites to proliferate and spread in male stomachs (Adedipe *et al.*, 2014). Female cattle had greater prevalence rates than male cattle, according to Simon-Oke and Awosolu (2021), Stephen *et al.* (2016) in Nigeria, and Moussouni *et al.* (2018) in Algeria. They reported that the higher prevalence observed in female cattle could be due to reduced immunity due to reproductive events and an insufficient/unbalanced diet compared to higher needs. In terms of age group, those between the age of 4-6 years had the highest prevalence (35.1%), followed by those aged 1-3 (25.5%) and those aged 7 and above (25.0%). However, the current study's findings demonstrate no statistically significant difference in age. In other words, the results of this study show that cattle of all ages are susceptible to gastrointestinal helminth infection. This is in line with our previous findings (Umar *et al.*, 2021) that found no significant differences in parasite infection by sex among the cattle investigated. However, this contradicts a previous study by Umar *et al.* (2018), who found that young cattle are more susceptible to gastrointestinal helminths than adults. They speculated that the young's higher incidence of gastrointestinal helminths could be due to their immune system's naivety and quick exposure to grassland harbouring many parasite eggs.

Compared to Sokoto Gudali cattle, the White Fulani breed had the highest predominance (30.4%). The higher prevalence of gastrointestinal helminths in White Fulani breeds observed in the current study could be due to the larger number of the breeds sampled. However, the difference in prevalence was not statistically significant. The statistically non-significant difference between the different types of cattle breeds and infection prevalence revealed in this study can be due to equal exposure of these animals to the same sources of pollutants such as water, soil, and pasture. However, the findings contrast our prior results in Azare, Northeast Nigeria (Umar *et al.*, 2021), which revealed considerable differences between breeds. Ola-Fadunsin *et al.* (2020) also discovered a

substantial difference in helminth parasite prevalence between the Sokoto Gudali and the white Fulani. The former was 2.3 times more likely to be infected. Various geographical locations, management practices, and the availability of a favorable microenvironment for sustained survival and development of the infective stage of most parasites might all be blamed for the variances in breed prevalence.

5.0 Conclusion

In conclusion, the Bogoro Local Government Area of Bauchi State cattle have gastrointestinal helminths, with nematodes being the most prevalent parasite. Thus, there is a need for appropriate control and preventive measures, such as strategic deworming of cattle and good management practices to reduce the parasitic burden and increase productivity. Also, public education is necessary about the zoonotic significance of helminth parasites.

Declarations

Ethics approval and consent to participate

Not Applicable

Consent for publication

All authors have read and consented to the submission of the manuscript.

Availability of data and material

Not Applicable.

Competing interests

All authors declare no competing interests.

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