


Gastrointestinal parasites of *Camelus dromedaries* in Sokoto, northwest Nigeria

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Introduction

The one humped camel (*Camelus dromedaries*) plays an important role in subsistence economy of the pastoral society of the northwestern Nigeria. They are mainly used for providing milk, meat and also for transportation. In addition, they are useful for socio-cultural practices such as prestige and compensation for dowry to mention a few (Mamman *et al* 2023). Camels are a sub-set of huge livestock resources in northern Nigeria. Camel population is estimated to be close to a million in Nigeria. They are mostly found inhabiting the arid and semi-arid areas of the country that constitute more than 60% of the total area and home of pastoral and agro pastoral communities (Mamman *et al* 2020). Despite the importance of dromedary in the pastoral areas of Nigeria, their potentials are not fully exploited due to factors such as malnutrition, poor management systems and inadequate veterinary services (Bekele *et al* 2022).

Several studies have reported that pathogenic diseases, poor nutrition and traditional management systems as well as lack of veterinary services have hampered their full utilization. Gastrointestinal (GIT) parasites are one of the major obstacles to growth and development of animal health. Prevalence of parasitic infestation in camels has been attributed to variable geo-climatic condition, shortage of food and lack of knowledge of farmers in treating GIT parasites resulting

Abstract

Gastrointestinal parasitic infections in camels are usually asymptomatic, thus goes unnoticed and untreated for a long period of time, often resulting in other serious health complications. A cross-sectional study was conducted from April to September, 2021 in Sokoto Central Abattoir to determine the prevalence and associated risk factors for gastrointestinal parasites in camels. Faecal samples were collected from the rectum of 300 camels and examined by the floatation and sedimentation techniques. Gastrointestinal (GIT) parasite eggs were identified by microscopic examination in comparison to standard keys. Overall, 194 out of the 300 (64.66%) faecal samples harboured at least one parasite. The majority of parasite eggs detected were nematodes (76.0%) followed by protozoan (14.0%), cestodes (10.7%) and trematodes (3.3%). *Strongyle* spp. (37.33%), *Trichostrongylus* spp. (19.33%) and *Trichuris* spp. (13.33%) were the most frequently encountered parasites. The differences in occurrence of parasites across sex, age, body condition and breed of the camels were not statistically significant ($p > 0.05$). The need for awareness campaigns to camel owners and mass chemoprophylaxis exercise cannot be overemphasized. Government and private sector collaborations will have a wider coverage area and make a lot of impacts.

to proliferation of the parasites and the diseases they cause (Durrani 1991). Numerous parasites infect camels; many are responsible for enteric infection (Parsani *et al* 2008). Camels can acquire helminths infection by grazing on infested pastures or by ingesting infective larvae when drinking water (Fowler 1996).

Camelids are affected by different types of GIT parasites. A number of these helminths are Camelids specific, but some are also common to other hosts, especially domestic ruminants and wild animals (Wernery and Kadden 2002). Gastrointestinal helminthic infestation is one of the major causes of impaired milk and meat production, as well as low fertility and low calving rates of camels. It causes losses through morbidity and hidden effects on feed intake, efficiency of nutrient utilization and also reduces growth rate in young animals. As a result, it leads to reduction in productivity and performance of the infected animals (Bekele 2002).

Helminth infestation is prevalent in camel and it imposes considerable constraints on camel health and production, thereby causing economic losses to camel owners (Bekele 2002). *Haemonchus longistipes* is the most pathogenic enteric nematode of camels that may be associated with *Trichostrongylus* species, which contribute to the debilitating effects of gastrointestinal nematodes (Chabra and Gupta 2006). Previous studies have shown that higher proportion of pastoralist camels

were infected by one or more helminthic parasites. On the basis of faecal samples and post-mortem examination, the prevalence of helminths was estimated at 92% of the animals examined (Muhomed *et al* 2017). Fourteen helminths species were identified on post-mortem examination of camels. They included *Moniezia* species, *Stilesia avittata*, *Avitellina centripunctata*, *Trichuris globosus*, *Haemonchus contortus*, *Impalpia somaliensis* and *Trichostrongylus* species (Demelash *et al* 2018). Mixed infections with *Haemonchus*, *Trichuris*, *Cooperia*, *Nematodirus* and *Trichostrongylus* species, have been reported (Richard 1979).

Heavy helminthic infection causes significant impact in these animals resulting in high morbidity and mortality. Despite the importance of camels in the subsistence economy in the arid and semi-arid areas of the country, camel husbandry and control of parasitic diseases are carried out using traditional methods. This approach is unreliable and therefore sufficient information on GIT parasites of camels in Nigeria are not readily available. Thus, there is the need for more research in this area to provide up-to-date information to augment the existing data on GIT parasites of camels in the study area. This study therefore, determined the

prevalence of GIT parasites of camels and their risk factors in Sokoto, northwestern, Nigeria.

Materials and methods

Study area

The study was conducted in Sokoto town which is located in the extreme northwest of Nigeria (Figure 1). The Sokoto Central Abattoir is located at the central area of the metropolis (13.06°N/5.24°E), with an annual average temperature of 37°C. The abattoir is the main centre of commerce for both local and international trade on animals from within the state and neighboring states of Kebbi and Zamfara as well as across international bordering country of Niger Republic.

Animal ethics

Approval for this study was granted by the Institutional Animal Use and Care Committee (IAUCC) of the National Veterinary Research Institute (NVRI) in Vom, Nigeria, with the approval number (AEC/02/88/20).

Study design and period

A cross-sectional study was carried out from September 2020 to April 2021 to determine the prevalence and risk factors associated with gastrointestinal parasites infecting camels in the study area.

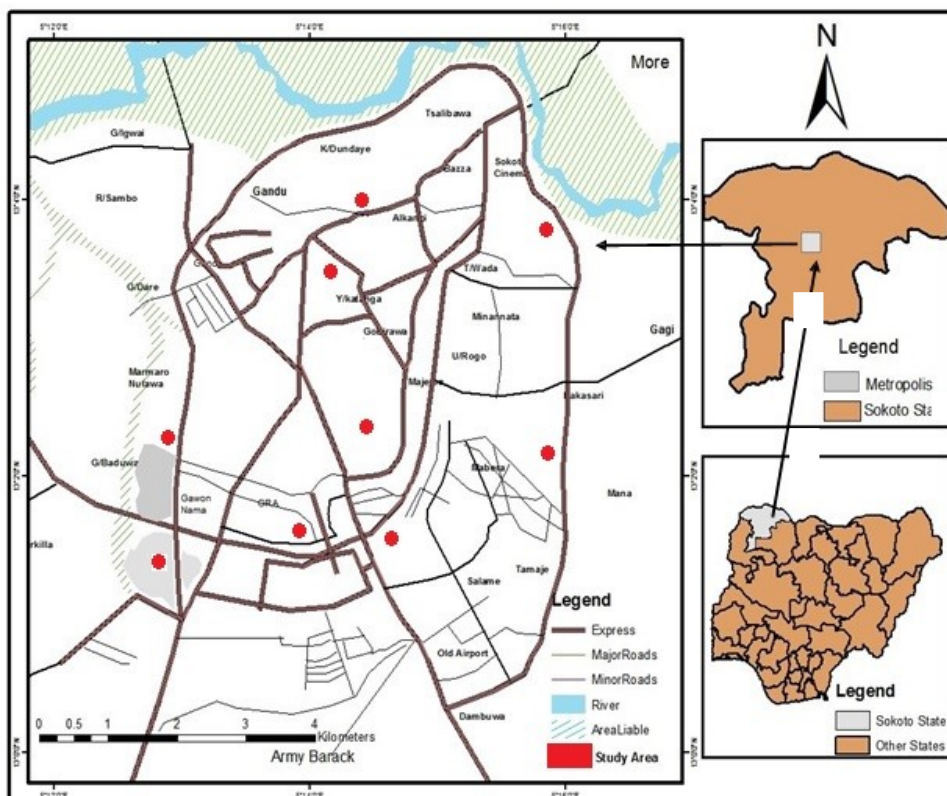


Figure 1. Map of the Sokoto Metropolis showing the study area (Map of Nigeria and Sokoto State inserted)
Source: Centre for Remote Sensing, Jos

Study Animals

A total of 300 camels (*Camelus dromedarius*) of all ages comprising of 164 males and 134 females in varying body conditions that were meant to be slaughtered in the Sokoto Central Abattoir were included in the sampling without discrimination. The age of the camels was

determined based on dentition (Bello *et al* 2013). Body condition scoring of the animals was performed by looking at the visible bones and muscles (Bekele *et al* 2022). The camels were grouped into two age-groups, young (1-4 years) and adult (>4 years).

Sample Size Determination

The total number of camels required for this study was calculated based on the formula given by Thrusfield, 2005. Previous prevalence of 78.0% as reported by (Mahmuda *et al* 2014) was used with 5% desired level of precision and 95% confidence level. Therefore, 269 samples were determined from the formula. $N = 1.962^2 P_{exp} (1 - P_{exp}) / D^2$. To take the precision to be near accurate, the sample size was taken as 300 for the study.

Sample collection

Fecal samples were collected directly from the rectum in a separate container, labelled and placed in ice box. The samples were transported to Parasitology Division Laboratory, National Veterinary Research Institute (NVRI), Vom, Plateau State and processed using standard parasitological procedures. The processed samples were examined for the presence of eggs using centrifugal sedimentation and simple floatation (Jorgen and Perry 1994) method. Helminth eggs or other developmental stages were identified using morphological keys (Soulsby and Mönig 1984)

Data analysis

Data were analyzed using descriptive statistics. Proportion of positive samples relative to the total samples tested was expressed as percentage prevalence. The association between variables, age, sex, body conditions and breed was determined using the Chi-square test; the level of significant was set at $p < 0.05$.

Results

Gastrointestinal parasite eggs were detected in 194 out of the 300 (64.7%) camels examined. From the 194 infected camels, 102 (52.6%), 72 (37.1%) and 20 (10.3%) harboured one, two or more gastrointestinal parasite egg types. Majority of the parasites encountered were nematodes, 228(87.7%) followed by protozoan 20(7.7%), trematode 10(3.8%) and Cestode 2(0.7%) (Table 1). The proportion of each parasite among the positive camels was highest for *Strongylus* spp., 112 (43.1%), followed by *Trichomera* spp. 58(22.3%), *Trichuris* spp. 40(15.4%) and *Eimeria* spp. 20(7.7%), while *Oxyuris* spp. *Gastrodiscus* spp. and *Moniezia* spp. were the least, 2(0.7%) each. The overall prevalence of the parasites was statistically non-significantly associated with sex, age, body condition and breed (Table 2).

Discussion

The prevalence of GI parasites in camels in Sokoto, which was 64.66% in the present study is lower than earlier reported prevalence of 78.0% in Northwest (Mahmuda *et al* 2014) and 68.9% and 69.3% in Northeast Nigeria (Kamani *et al* 2008; Wakil *et al* (2017). Previous studies from Somalia, Egypt, India and Algeria show varying prevalence of 17.2% to 60.7% (Ibrahim *et al* 2016; El-Khabaz *et al* 2019; Parmar *et al* 2019; Bouragba *et al* 2020). These variations could be as a result of the occurrence and magnitude of parasites, which might be associated with camel husbandry

practices, availability of veterinary services, laboratory techniques used and environmental factors.

Table 1: Prevalence and diversity of gastrointestinal parasites in camels

Group	Identified Genera/Species	Number of Parasites (%)
Nematodes	<i>Strongylus</i> spp.	112(43.1)
	<i>Trichomera</i> spp.	58(22.3)
	<i>Trichuris</i> spp.	40(15.4)
	<i>Oxyuris</i> spp.	2(0.7)
	<i>Strongyloides</i> spp.	6(2.3)
	<i>Ascaris equorum</i>	8(3.1)
	<i>Gastrodiscus</i> spp.	2(0.7)
Protozoa	<i>Eimeria</i> spp.	20(7.7)
Trematode	<i>Fasciola</i> spp.	10(3.8)
Cestodes	<i>Moniezia</i> spp.	2(0.7)
Total		260

Table 2: Risk factors for gastrointestinal parasites of camels

Risk Factors	Number Examined	Number Infected (%)	p-value
Sex			
Male	164	101(61.58)	0.220
Female	136	93(68.38)	
Age			
Young	77	50(64.93)	0.954
Adult	223	144(64.57)	
Body condition			
Good	50	31(62.00)	0.895
Medium	180	118(65.56)	
Poor	70	45(64.29)	
Breed			
Local	195	118(60.51)	0.400
Cross	105	76(72.38)	

A similar trend was reported in camels in Maiduguri, northeast, Nigeria where nematodes accounted for 55.4% of GI parasites detected (Wakil *et al* 2017). *Strongyle* spp. was the most frequently encountered parasites, followed by *Trichomera* spp. Similarly, reports from previous studies showed *Strongyle* spp. as the most frequently encountered parasite (Ahmed *et al* 2020; Regassa *et al* 2015; Bekele *et al* 2022), indicating that the GI parasites of camels are mostly nematodes.

The present study revealed that 47.4% of the infected camels harboured two or more GI parasites. This is lower than the 63.74% mix infections in camels in Afar Region of Ethiopia (Bekele *et al* 2022) but higher than 36.6% reported in Algeria (Saidi *et al* 2022). Collectively, these results are suggestive of wide spread multiple parasitic infections in GIT of camels across various regions.

In the present study, though the prevalence of GI parasite was higher in males than females, the difference is not statistically significant ($p > 0.05$). This is in contrasts to (Wakil *et al* 2017) in Northeast Nigeria who reported significant association ($p < 0.05$) between gender and the parasites prevalence. Similar findings were

reported by other authors (Ararsa *et al* 2014; Parmar *et al* 2019; Ahmed *et al* 2020).

The prevalence of GI parasites was higher in adult compared to the young camels, though the difference was statistically non-significant ($p>0.05$). This finding may be associated with several exposures of adult camels to the parasites during grazing compared to the young ones. This result is in agreement with the reports of (Duguma *et al* 2014) and Yakaka *et al* 2017) but differed from the report of (Saidi *et al* 2022).

There was also no significant association ($p>0.05$) between body condition score and GI parasites prevalence. This is contrary to the report of (Wakil *et al* 2017) and (Swail *et al* 2011) but is in accord with that of (Duguma *et al* 2014) who also reported the absence of association between the prevalence of GI parasites and the body condition scores. This discrepancy could be associated with the fact that, loss of body condition in the camels could be due to other factors such as seasonal changes and the presence of other disease conditions that may suppress the immune system and make the camel vulnerable to parasitic infection.

Conclusion

Though the prevalence of GI parasitic infections appears to be higher among some categories of camels, the differences were not statistically significant suggesting that camels in the study area may have equal exposure to gastrointestinal parasites. Understanding the risk factors for GI parasitic infection is essential for developing proper strategies for the control of the infections. Considering the large number of camels being slaughtered for human consumption, more research are needed to identify pathogens of veterinary and public health significance associated with camels in the study area.

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Conflict of interest

The authors declare no conflict of interest.

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