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Prevalence and Host Related Associated Risk Factors of Gastrointestinal Nematodes of Camels in Selected Districts of Borena Zone, Southwest Oromia, Ethiopia

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Abstract: Gastrointestinal nematodes are among several constraints hindering camel health and productivity in Ethiopia. A cross-sectional study was conducted from November, 2018 to April, 2019 in four selected districts of Borena zone, Oromia Regional State, Southwest Ethiopia. The prevalence of gastrointestinal nematodes in camel and associated risk factors was considered. Faecal samples were collected from 384 randomly selected camels and examined by direct smear, simple flotation technique, centrifugal sedimentation technique and fecal culture. The overall prevalence of gastrointestinal nematodes was 75%. Coprological investigation revealed that, camels in the district were infected with different species of nematodes. The *Strongyle* were the most prevalent nematodes (63.9%), followed by *Strongloides* (28.8%), mixed infection (4.2%) and *Trichuris* (3.1 %). Statistically significant difference ($p<0.05$) was observed between age and body condition scores of camels, but there was no significant difference ($P>0.05$) in the prevalence of gastrointestinal nematodes between district and sexes of the examined camels. The highest prevalence was observed in Elwayyi (80.2%), followed by Yabello (75%), Gomolle (73.9%) and the lowest at Arero (70.8%). This study showed that gastrointestinal nematodes are widespread and major constraint of camel health and productivity in four districts of Borena zone, Southwest Ethiopia. Therefore, to increase the health and productivity of camels, besides awareness creation emphasis should be given to strategic control of gastrointestinal nematodes using anthelmintic drugs.

Key words: Camel · Nematodes · Prevalence · Risk Factors · Borena · Oromia · Ethiopia

INTRODUCTION

The camel is an important livestock species uniquely adapted to hot arid environment [1]. World camel population is estimated to be around 25.89 million across 47 countries. About 85% of the camel population inhabits mainly in eastern and northern Africa and the rest in Indian subcontinent and Middle East countries [2]. In Ethiopia, camels are kept in the arid and semi-arid lowlands of the Borena, Ogaden and Afar regions, which accommodate over 50% of the pastoralists [3]. In Ethiopia, camels represent a subset of major livestock resources. In this area, the livelihood of pastoral communities is certainly ensured by dromedaries. According to the data obtained from CSA [4]; the camel population of Ethiopia is estimated at >2.4 million.

Camels have high economic value by providing meat, milk and wool as well as serving vital role in transportation and labor. They are very reliable milk producers even during the dry season and drought years when milk from cattle and goat is scarce [5]. Camels being having a very wide variety of diet are also able to use plant species not used by other livestock species [6]. However, pathogenic diseases, poor nutrition and traditional management systems as well as lack of veterinary services have restricted their full utilization [7]. The increased incidence of diseases is one of the limitations associated with camel production [8].

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Gastro-intestinal nematode infection is one of the major health problems, affecting the health of millions of people and animals in the world [9]. These parasites are generally known to contribute to loss of reproductive and productive performance in camels [10]. Numerous gastrointestinal parasites are responsible for enteric infection [11] and cause a great loss of production in camels [12]. Camels can acquire helminthes infections during grazing in infected pasture or drinking water. These parasites also predispose camels to other infectious diseases [13]. Some of these helminthes have also zoonotic implication for those who work closely with camels [14].

Currently, the primary control strategy for nematode infections is the use of chemical treatments [15]. Knowledge and information of camel management and parasitic diseases control in camels is still limited [13]. For prevention and control of gastrointestinal nematodes, periodic and consistent surveillance of the parasites is required in arid and semi-arid land areas of the country. Although, there is large number of camel population in Ethiopia, only few studies have been reported on the prevalence of gastrointestinal nematodes of these animals. Hence, this study is designed to determine the prevalence and associated risk factors of gastrointestinal nematodes in camels in four districts of Borena Zone, South West Ethiopia.

MATERIALS AND METHODS

Study Area: A study was undertaken in Yabello, Gomolle, Arero and Elwayyi districts, Borena zone Southwest, Ethiopia. Borana zone is one of the seventeen administrative zones of Oromia Regional State, located at about 570 km of Addis Ababa on the way to Kenya. Borena zone covers total land area of 63,939 km square with the total human population of 1,113,538, of which 881,121 and 232,417 were residing in rural and urban areas, respectively [4]. The Borena plateau represents a lowland area with arid and semi-arid climate. The area has a bi-modal type of rainfall regime ranging on average from 400 mm in the South to 600 mm in the North annually. The mean minimum and maximum annual temperature range is from 24°C -29°C. Extensive pastoral livestock production system with mobility is the vital source of food and income for livelihood of the society, while opportunistic cultivation is practiced around towns. The dominant vegetation in the area is savanna type. The total livestock population of Borena zone is 1,056,040 cattle, 573,369 sheep, 686,571 goats, 81023 donkeys, 1096 horses, 3,149 mule and 51,607 camels [4].

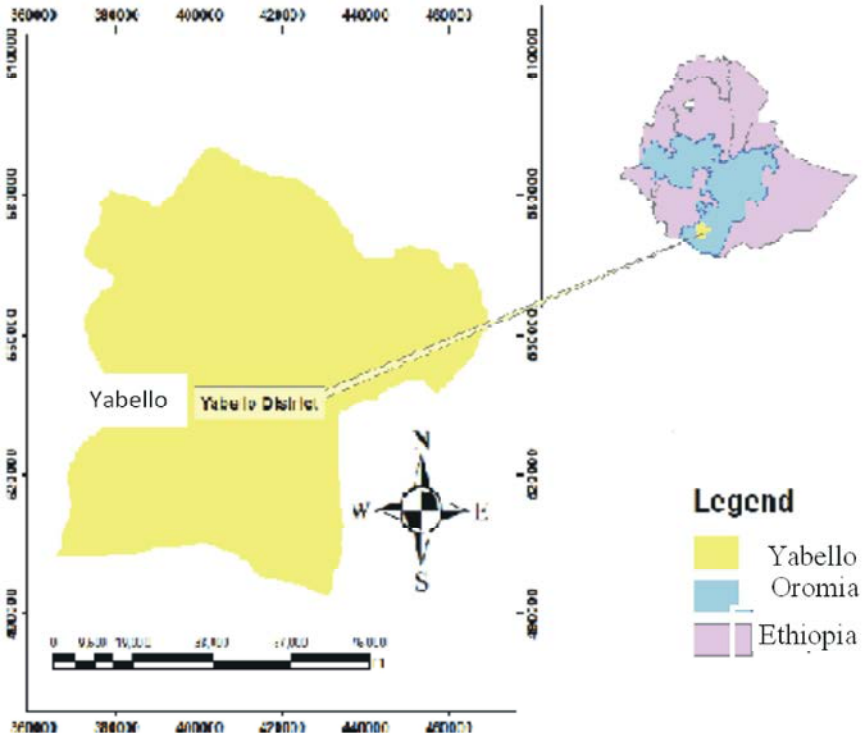

Fig. 1: Map of the study area, Borena Zone, Southwest Oromia, Ethiopia

Study Population and Sample Size: The study population consisted of indigenous breeds of one humped camel reared under a pastoral management system which allows free grazing, usually mixed with livestock from other villages. In this study, animals older than one year of age were included irrespective of their sex and body condition score. The sample size was determined using the formula given by Thrusfield [16] with an expected prevalence of 73.8% [17], at 95% confidence interval and 5% desired absolute precision. Accordingly, the sample size required for this study was 297, but to increase the precision of sampling in the study, 384 camels were considered. During sampling sex, age, body condition scores, treatment history and the presence of clinical signs were recorded.

Study Design and Sampling Strategy: A cross- sectional study was conducted to determine the prevalence and to assess the risk factors associated with gastrointestinal nematodes of camels in Yebelo, Arero, Gomolle and Elwayi districts from November, 2018 to May, 2019. From these districts 17 pastoral associations were selected from lowland (Elwayi) and midland (Yabello, Arero and Gomolle) and equal proportions of fecal samples were collected from each district. These areas were purposively selected based on the high accessibility and large camel population. The prevalence was determined in respect to host related risk factors (age, sex and body condition score). Age was determined by dental eruption according to [18] and divided into two age categories (≤ 4 years and >4 years). The body conditions of camels were categorized as good, medium and poor according to [19]. All study animals were randomly selected from the population at temporary livestock camps ("*Fora*") and permanent livestock camps ("warra").

Sample Collection and Laboratory Examinations: Approximately 15g of fresh fecal samples were collected directly from the rectum of individual animal by using clean hand gloves into separate universal bottles. Proper dating, labeling and coding of the samples were done on the universal bottles. Collected feacal samples were examined by direct smear, simple flotation method and centrifugal sedimentation technique and fecal culture as described by Urquhart *et al.* [20]. Floatation fluid, saturated NaCl solution, was used to concentrate nematode eggs. All parasite eggs were identified morphologically as described by Max *et al.* [21] and [22]. Potassium dichromate was added for preservation and culturing purpose. Those samples found positive for gastro-intestinal nematode infection were subjected to fecal culture and the infective larvae (L3) are differentiated to genera level based on their morphological characteristics as described by [24].

Data Analysis: Statistical analysis was performed using IBM SPSS version 20. Descriptive statistical tools such as frequency and percentages were used to describe the data and for assessment of the prevalence of gastrointestinal helminthes. The Ch-square (x^2) test was used for comparison of differences in the prevalence and association of potential host related risk factors. P-value less than 0.05 were considered as significant.

RESULTS

Out of 384 fecal samples collected and examined, 288 were found positive for gastrointestinal nematodes with an overall prevalence of (75%). Camels were invariably infected with different gastrointestinal nematodes. *Strongyle* (63.9%) was the dominant nematodes followed by *Strongloides* (28.8%), mixed infections (4.2%) and *Tricuris* (3.1%) (Table 1).

The prevalence of gastrointestinal nematodes of Camels based on study districts, Borena Zone, Southwest Ethiopia: In present study, there was no statistically significant difference ($p>0.05$) in the prevalence of gastrointestinal nematodes between different districts. However, the highest prevalence was observed in Elwayyi (80.2%) followed by Yabello (75%) and Gomolle (73.9%) and the lowest in Arero(70.8%) (Table 2).

The Prevalence of Gastrointestinal Nematodes of Camels with Different Potential Risk Factors: The prevalence of gastrointestinal nematodes was slightly higher in female (76.4%) than in male camels (71%). However, the difference was not statistically significant ($p>0.05$) between sex categories (Table 3).

In the present study, the prevalence of gastrointestinal nematodes was found to be (61.7%) and (83.4%) in young and adult camels, respectively and the result was statistically significant different ($P <0.05$) between age categories (Table 3). The prevalence of gastrointestinal nematodes in poor body conditioned camels (90%) was significantly ($P<0.05$) higher than in animals with medium (77.8%) and good (69.7%) body condition scores (Table 3).

Table 1: Prevalence of gastrointestinal nematode based on species of parasites of camels in Selected Districts of Borena Zone, Southwest Ethiopia

Species of Nematodes	No positive	Prevalence (%)
Strongyle	184	63.9
Strongloides	83	28.8
Tricuris spp.	9	3.1
Mixed infections	12	4.2
Total	288	75

Table 2: Prevalence of gastrointestinal nematodes of Camels based on study districts in selected districts of Borena Zone, Southwest Ethiopia

Risk factors District	No. of animals examined	No. of positive animals	Prevalence (%)	Chi-square	p-value
Elwayyi	96	77	80.2	0.891	0.828
Yabello	96	72	75		
Gomolle	96	71	73.9		
Arero	96	68	70.8		
Total	384	288	75		

Table 3: Prevalence of gastrointestinal nematodes of camels with different potential risk factors in selected districts of Borena Zone, Southwest Ethiopia

Potential risk factors	Nº of examined	Nº of positive	Prevalence (%)	Chi-square	p-value
Sex					
Female	284	217	76.4	1.154	0.283
Male	100	71	71		
Age					
≤ 4yrs(young)	149	92	61.7	22.814	<0.001
≥ 5yrs(adult)	235	196	83.4		
Body condition scores					
Poor	50	45	90	8.172	0.017
Medium	126	98	77.7		
Good	208	145	69.7		
Total	384	288	75		

DISCUSSION

The current study indicated that, gastrointestinal nematodes were one of the main problems of camel health in Yabello, Gomolle, Elwayyi and Arero districts, Borena zone, Southwest Ethiopia. Overall, 75 % of the camels examined were infected by parasites. Prevalence of gastrointestinal nematode in this study is incoherence with Bekele [7] in Eastern Ethiopia (75%), Borji *et al.* [13] in Iran (75.1%) and Mahmuda *et al.*[24] in Sokoto metropolis, Nigeria (78%). However, this finding has lower prevalence rate as compared to Tekle and Abede [25] in Eestern Ethiopia (96.9%), Bamaiyi and Kalu [26] in Nigeria (92.4%) and Sharrif *et al.* [27] in Jordan (98%). In contrast, lower prevalence of gastrointestinal nematodes was reported by different researchers [8, 28, 29]. The differences between the results of these studies might be due to differences in agro-climatic conditions of the study areas, periods of sample collection or due to the husbandry system being employed by the pastoralist.

In this study, three different types of gastrointestinal nematodes were identified in camels. The most prevalent gastrointestinal nematodes identified were *Strongyle* (63.9 %). The high prevalence of *Strongyle* species has in agreement with findings of Mahmuda *et al.* [24], Bamaiyi and Kalu [26], Kasahun *et al.* [30]. The study also showed that, *Strongloides* (28.8%) was prevalent next to *Strongyle,* but Ukashatu *et al* [31] and Mahmuda *et al.* [32] reported 4.3% and 6.67% respectively. Mixed parasitism (4.2%) involving two or more helminthes was less common in the study and is in agreements with the results of other researchers [8, 33].

There is no significant difference (P>0.05) in the prevalence of gastro-intestinal nematodes among the four districts. However, the highest prevalence was observed in Elwayyi (80.2%) and the lowest in Arero (70.8%). The possible explanation for these variations could be variations in agro-ecological conditions, husbandry practices, sample size variations and differences in veterinary service delivery [34, 35]. Moreover, the occurrence of parasite infection is

associated with nutritional status, level of immunity, rainfall, humidity, temperature differences and season of examination.

Although female camels were more infected with nematodes as compared to males, the prevalence was not statistically significant (P>0.05). Bamaiyi and Kalu [26] and Duguma *et al*., [36] similarly reported higher nematodes burden in female camels as compared to the male ones. The slightly higher prevalence in females may be due to the physiological peculiarities of the female camels which usually constitute stress factors, which reduces their immunity to infections [8]. But this result is inconsistence with Bekele [7] in semi-arid lands of Eastern Ethiopia; Duguma *et al*., [36] inYabello district, Southern Ethiopia and Mahmuda *et al.* [24] in Nigeria, who reported a high prevalence of gastrointestinal parasites in male camels than in females.

Host age was a significant factor with eggs being detected more frequently in older animals. The prevalence of gastrointestinal nematodes was 61.7% and 83.4% in younger and in older animals, respectively. This result is in agreement with Duguma *et al*., [36] who reported increasing rate of gastrointestinal nematodes infection with age of camels. The higher prevalence in older animals may be associated with several exposures of adult camels to the parasites during grazing as compared to the young ones Duguma *et al.,* [36]. However, our finding is inconsistent with findings of Keyyu *et al.* [37], who reported no significant association between gastrointestinal parasites infection and the age of camels.

Body condition score of the study camels was another risk factor that has showed statistically significant difference (p<0, 05) in the prevalence of gastrointestinal nematodes. Camels with poor body conditioned were more infected (90%) than medium (77.8%) and good (69.7%) body conditioned animals. This result is in agreement with Swai *et al.* [8] and Keyyu *et al.* [37], who observed higher prevalence of gastrointestinal nematodes in poor body conditioned camels. Generally poorly nourished animals appear to be less competent in getting rid of infection although it is unusual for well fed animals to succumb the disease in right environmental conditions [38].

CONCLUSION

In conclusion, gastrointestinal nematodes are one of the core camel health and productivity problems in the study districts of Borana zone, Southwest Ethiopia. Three genera of nematodes: *Strongyle, Strongyloides, Trichuris* and mixed infections were identified in studied camels. The present study confirmed that, age and body condition scores of animals are significant risk factors for camel gastrointestinal nematodes in the study districts. Therefore, for control of these parasites, besides awareness creation and good management practices strategic deworming of camels using broad spectrum anthelmintics are paramount important.

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