

Research Article

Prevalence and Associated Risk Factors of Major Prevalent Gastrointestinal Nematodes in Camels of Borena Zone, Southern Ethiopia

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Abstract

Gastrointestinal nematodes are one of the most important parasites diseases of the camel in camel producing areas. It causes substantial economic losses in terms of a decrease in working capacity, growth and productivity to owners and serious diseases in animals. The aim of the study was to estimate the prevalence of gastrointestinal (GI) nematodes and to identify associated risk factors of nematode infection of camels in the study area. A cross-sectional study was conducted from October 2018 to April 2019. The age, sex, body condition, management and herd size of the camels were registered properly as risk factors while collecting fecal samples. Collected fecal samples were labeled properly and transported to Yabello Regional Veterinary Laboratory in the icebox. Samples examined in the laboratory using flotation techniques. From 384 fecal samples 75.0% (288/384) samples were found positive to gastrointestinal nematodes. Coprological investigation revealed that camels in the study area were infested with varieties of nematode parasites. Strongyles were the most prevalent nematode parasites identified with 47.9% prevalence followed by Strongloides species 21.6%, mixed infection 3.2% and Trichuris 2.3 per cent. Age and body condition showed significant association ($p < 0.05$) while sex and herd size had no significance ($p > 0.05$) with the prevalence of nematodes. Overall, the high prevalence of nematode parasites was observed in the study area, which implies nematodes are major constraints of the production and productivity of camels. Therefore, teaching and awareness creation on management and de-worming of camels should be implemented based on to prevention and control of the disease.

INTRODUCTION

Camel (*Camelus dromedarius*) is a primary livelihood asset in the arid and semi-arid lands and has a special significance in the life of the pastoralists. Camel provides these communities with tangible benefits (income, milk, meat, transportation, and hides) and intangible benefits (status symbol, insurance, risk aversion, and social capital). The pastoralists see camels as a banking system or security against drought, disease, and other natural disasters that affect smaller stock more seriously [1].

Camel population is numerous in the arid areas of Africa, particularly in the arid lowlands of Eastern Africa namely, Somalia, Sudan, Ethiopia, Kenya and Djibouti [2]. Ethiopia is one of the largest camel populated countries in the world with 1,102,119 numbers of camels that rank third in Africa next to Somalia and Sudan, those are kept in the arid and semi-arid lowlands of the Borena, Ogaden and Afar regions, which accommodate 50% of the pastoralists [3].

Camel is the most important livestock that can live and produce

in poor farms and can be compared with high-yield animals of the same weight, like cattle, in productivity under manual feeding. Hence, there is a need to improve the management of camels considering its prospect in the semi-arid and arid regions where livestock production is becoming more difficult due to climate changes [4]. Gastrointestinal parasites may assume a much more significant role in camel husbandry because parasites not only reduce the productivity and performance of camels but also predispose to other infectious diseases [5]. Moreover, parasitic diseases may also predispose them to other infections, lower the working efficiency or result in death, and sometimes serve as a potential danger for public health [6]. With the introduction of sedentary, semi-intensive camel farming systems, parasites may assume a much more significant role in camel husbandry [7].

Camels can acquire helminths infection by grazing on infected pastures or by ingesting infective larvae with drinking water. Signs and symptoms of gastrointestinal helminths in camels are numerous, mainly weight loss along with growth disorders, colic, fever, diarrhea, anemia, gastritis, and enteritis [8]. However,

the clinical manifestations of helminthosis may be subclinical or asymptomatic, in which case the animal appears normal but performs below its full potential [5]. A number of helminths are camelids specific, occasional but some are also common to other hosts, especially domestic ruminants and wild animals [9].

Among the Nematodes, some appear to be practically specific to the dromedary. Camel specific nematodes are included; *Haemonchus longisipes*, *Nematodirus Mauritanicus*, *Nematodirus dromedarii* but most of the camel Nematodes are also common to sheep and goats, like *Trichostrongylus prololurus*, *T.vitrinus* *Ostertagia mongolica*, *Nematodirus spathiger*, *Oesophagostomum venulosum* [10]. Nematodes are the most numerous, complex and variable among worm parasites of domesticated animals. They come in all size and shapes, they infect a variety of organs and organ systems, and they can produce significant pathology in domesticated animals [11].

Knowledge of camel husbandry practice and parasitic disease control is still insufficient. There was no well-documented research conducted at the study area. This indicates the need to perform the study on prevalence and associated risk factors of major GIT nematode of the camel. Therefore the study was designed to study the prevalence and associated risk factors of major gastrointestinal nematodes of the camel in selected study districts of Borena zone.

MATERIALS AND METHODS

Study area

The study was conducted in four selected districts of Borana zone namely, Yabello, Gomole, Arero and Elwaye district. The study area Borana, is represented by plateau in lowland area with arid and semi-arid climate. The annual mean daily temperature of the area ranges from 19-24 Agro-ecologically Yabello district has lowland and midland areas and capital of Borana zone, located at 570 km South of Addis Ababa. It has latitude and longitude of (4° 53' 24 N and 38° 4' 48 E) and an elevation ranging from 350-1857 meter above sea level (masl).

The average annual rainfall ranges from 300-700mm of which 65% received from April-June (locally called 'ganna') and remaining 35% received from September-November (locally called 'hagayya') with considerable spatial and temporal variability in quantities and distribution. Extensive pastoral livestock production system with mobility is the vital source of food and income for livelihood of people while opportunistic cultivation is practiced around towns where the soil moisture content stays high for longer time. The dominant vegetation in the area is savanna type. The total livestock population of Yabello district is composed of 83,717 cattle, 42,491 sheep, 84,159 goat and 18,613 camels [12].

Elwaye district was found at 25km in South western direction of Yabello town while Arero district locate at 105km East direction of Yabello ,Gomole districts located at 45km North of Yabello two on Addis Ababa road.

Consequently, herd splitting is practiced to cope up with shortage of resources in case of cattle likewise the camel herds are moving from areas with low water and feed to the areas with relatively good water and feed availability [13].

Study population

The study animals consisted of indigenous breeds of one humped camel (Camels dromedaries) reared under pastoral management system which allows free grazing, usually mixed with livestock from other villages, the animals move from feed shortage area to feed abundant areas especially during drought season. Camel of all age categories and both sexes were included in study. The study animals was camels in pastoral districts of Yabello, Elewayye, Gomale and Arero. Both Male and Female was included into the sampling producers in regardless of sex, age, body condition score in study. Age was estimated young for < 4 years and > 5 adult years.

Study design

A cross sectional (observational) study was conducted from November, 2018 to May, 2019 to determine (estimate) the overall prevalence of camel gastrointestinal nematode parasite in Yabelo, Arero, Gomole and Elwayi districts. The districts were purposively selected based on accessibility and existence of large camel population the districts. The prevalence was determine in respect to the number of risk factors such as host factors (age, sex, and body condition), the environmental and management factors included. All study animals were randomly selected from the population at temporary livestock camps ("Fora") and permanent, livestock camps ("warra"). The animals was selected by simple random sampling technique. From four (4) districts of Borana zone 17(seventeen) pastoral associated (PA) were selected from lowland and midland areas. Elwayye district was from lowland, where as Yabello, Arero and Gomole were from midland.

Sample size determination

The total numbers of camel to be included by probability sampling was 384 animals which are randomly selected from pastoral association. The proportion of camel female and male is not equal so that their number also varies to be a sample and the woreda has high number of female camel as compared with male camel because the pastoralist use one or two male for mating depending up on female number and other males use income generation or for sale. The number of animals sampled for study was estimated by the formula described by Thrusfield [14]. We calculated the total sample size, by taking 95% confidence level (CL), 5% desired level of precision; and parameters was used: assumption of 50% expected prevalence of gastrointestinal nematode parasites among camel in the study area.

$$n=1.962 \times P_{exp}(1-P_{exp})/d^2$$

when: n=required sample size; P_{exp} =expected prevalence
d=desired absolute precision. Hence, by using this formula, the sample size was calculated 384 in random sampling technique.

Study methodology

Sample collection and laboratory analysis: Fresh fecal samples were collected directly from the rectum of selected animal by using, clean hand gloves and approximately 15g amount of feces was placed into separate universal bottles. Proper dating, labeling and coding of the sample were done on the universal bottles and Potassium dichromate was also added which help

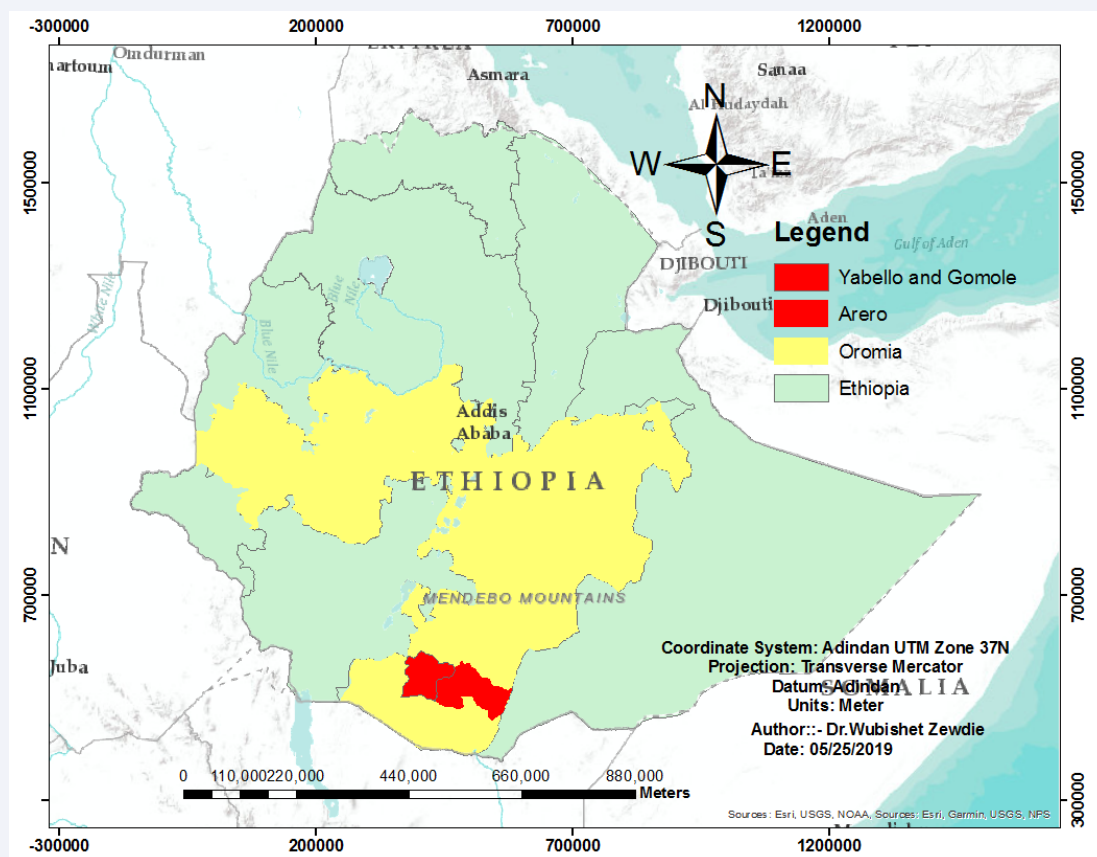


Figure 1 Map of study districts.

for preservation and culturing purpose. Animal attributes such as sex, age, management and body condition score of camels were also recorded. Collected fecal samples were immediately transported to Yabello Regional Veterinary Laboratory. The majority of samples were processed on the same day of sample collection. Those samples which were not examined immediately after the arrival at laboratory were stored at +4°C and examined the next day. The collected fecal specimens were processed and examined by direct fecal floatation technique using saturated salt solution for qualitative investigation of the types of gastrointestinal nematode eggs following the standard procedure [15].

Those samples found positive for gastro-intestinal nematode infection were subjected to fecal culture to differentiate species involved and then the infective larvae (L3) are differentiated to genera level based on their morphologic characteristics described [16]. The collected samples were examined under parasitological technique [15].

Data Analysis

Data collected from individual animals and parasitological examination results were entered and analyzed by SPSS version 20. Descriptive statistical tools such as frequency and percentages were used to describe the data. The data were analyzed using Chi-square (χ^2) test to assess the association of the associated risk factors with the prevalence of the parasites. For this analysis if P-value is less than 0.05 considered as significant.

RESULT

In present study, the coprological examination revealed an overall prevalence of 75.0% (288/384) for gastrointestinal nematodes infection. The result of this study identified the GI nematodes present in camel one or more genera of nematodes infection were recorded. This study shown that the prevalence of GI nematodes of camels harboring nematode eggs was considerably high in which Strongyle were highest (47.9%), followed by Strongloides species (21.6%), mixed infection eggs (3.2%) and Trichuris species (2.3 %) were detected (Table 1).

Risk Factors and Prevalence of Gastrointestinal Nematodes Infection in Camel

This study showed that there was insignificant difference ($p>0.05$) on the prevalence of gastrointestinal nematodes infection between different district from which animals were sampled. However, the highest prevalence was observed in Elwayye (78.0%) followed by Arero (75.6%) and Gomolle (74.0%) and the lowest was observed at Yabello (72.4%) (Table 2).

Females and males were found to be infected with a prevalence of (76.4%) and (71.0%), respectively. The prevalence of different species gastrointestinal nematodes different in different sex and the prevalence higher in female than male. However, statically there was insignificant differences between sex ($p>0.05$) (Table 3).

Table 1: Prevalence rates of the various gastrointestinal species of nematodes in camels.

Species of Nematodes	No positive	Prevalence (%)
Strongyles	184	47.90%
<i>Strongyloides</i> species	83	21.60%
<i>Trichuris</i> species	9	2.30%
Mixed infestation of eggs	12	3.20%
Total	288	75.00%

Table 2: Prevalence of gastrointestinal nematodes based on district.

Risk factors District	Animals examined	Positive animals	Prevalence (%)	Chi-square	p-value
Elwayye	100	78	78.00%	0.891	0.828
Arero	90	68	75.60%		
Yabello	98	71	72.40%		
Gomole	96	71	74.00%		
Total	384	288	75.00%		

Table 3: Prevalence of gastrointestinal nematodes based on sex.

Sex	Animals examined	Positive animals	Prevalence (%)	Chi-square	p-value
Female	284	217	76.40%	1.154	0.283
Male	100	71	71.00%		
Total	384	288	75.00%		

Study was also conducted to see the influence of age on the prevalence of GI nematode with respect to age and revealed that there was statistically significant association ($p < 0.05$) between those age groups. Between the age of groups prevalence of gastrointestinal nematode was (61.7%) in Young and (83.4%) in adult was observed in study area (Table 4).

The prevalence of gastrointestinal nematode in different body condition scores of the study animals was (Table 5) statistically significant ($p < 0.05$). The study showed that highest prevalence of the parasites was in poor body conditioned camels (90.0%) as compared to medium (76.2%) and in good (70.7%) body conditioned camel.

Prevalence of each species of GI nematodes of camel with respect to risk factor

The overall prevalence species of GI nematodes of camel in relation to sex, and age of animal. Based on sex; 51.7, 20.1, 2.1, 2.5 and 37.0, 26.0, 3.0, 5.0% (Strongyles, Strongyloides species, Trichuris species, and mixed eggs infection) was observed in female and male of animal respectively. According to age; 30.2, 28.2, 2.7, 0.6 and 59.2, 17.4, 2.1, 4.7% (Strongyles, Strongyloides species, Trichuris species, mixed egg infection) was observed in young and adult animals, respectively (Table 6).

DISCUSSION

According to the result of the study it was found that GIT nematodes are one of the main problems of camel health in the study area. Overall, 75.0% (288) prevalence of GIT nematodes was recorded. This finding is in agreement with the result of

other researchers [17,18]. This findings coincides with previous reports of overall infestation rate of 80.73% in Yabello [19], 78.0% in Sokoto metropolis [20] 75% in Nigeria [5], 75.1% in Iranian camels [21], 75% in eastern Ethiopia [22] and 76.2% in Bahrain [23]. However, this finding was comparatively lower than prevalence reports of 92.4% in Nigeria [24], 96.9% in eastern Ethiopia [25] and 98% in Jordan [26]. In contrast, this result was higher than prevalence reports of 26.9% in camels of Egypt [27], 28.4% in the camels of the desert that of Pakistan [28], 37.3% in camels of Faisalabad [29], 62.7% in northern Tanzania [6,30] and 68.9% dromadaries in Nigeria [31]. Relatively the higher prevalence of GIT nematodes of camels in the study area could be attributed to lack of improved animal health management system and lack of knowledge of farmers in treating GIT parasites. The possible explanation for the country to country variation in the infestation rate could be variations in agro-ecological conditions between countries, which favor or disfavor the survival of parasites eggs and larvae, management system and husbandry practices [31,32].

The prevalence in camels harboring nematode eggs was considerably high with Strongyles as highest (47.9%), followed by Strongyloides species (21.6%), mixed infection eggs (3.2%), and Trichuris species (2.3 %), and this is in agreements with the results of other researchers [18,22,33]. Prevalence of nematode with regard to age in the present study was statistically significant association ($p < 0.05$) between those age groups. Between the age of groups prevalence of gastrointestinal nematode was (61.7%) in young and (83.4%) in adult was observed in study area. This is in agreement with [19], who reported increasing rate of infestation with age of camels. The tendency of higher prevalence in adult age in the present study can be associated with the increase chance of parasitic encounter along with the decrease of body immunity against infestation [19]. Regarding the relation of egg per gram of fecal (EPG) with age there was a significant association ($p = 0.000$) between the age and the severity of infection and this is in agreement with [34]. A significant difference was observed in prevalence of GIT nematode infection in relation to body condition (BCS) such that shedding of nematodes eggs increased in animals with poor body condition (90.0%) compared to animals with medium (76.2%) and good body condition (70.7%) ($P < 0.017$). This is in agreement with [33,35].

Table 4: Prevalence of gastrointestinal nematodes based on age.

Age	Animals examined	Positive animals	Prevalence (%)	Chi-square	p-value
≤4yrs(young)	149	92	61.70%	22.814	0
≥5yrs(adult)	235	196	83.40%		
Total	384	288	75.00%		

Table 5: Nematode based on body condition score.

Body Condition Score	N° of examined animas	N° of positive animals	Prevalence (%)	Chi-square	p-value
Poor	50	45	90.00%	8.172	0.017
Medium	126	96	76.20%		
Good	208	147	70.70%		
Total	384	288	75.00%		

Table 6: Prevalence of each species of GI nematodes of camel with respect to risk factors.

Risk factors	Animals		Prev. (%)	Prevalence of GIT Nematodes Species (%)			
	Examined	Positive		Strongyles	<i>Strongyloides</i>	<i>Trichuris</i>	Mixed eggs
					Spp	Spp.	
Sex							
Female	284	217	76.40%	51.70%	20.10%	2.10%	2.50%
Male	100	71	71.00%	37.00%	26.00%	3.00%	5.00%
Age							
≤4yrs(young)	149	92	61.70%	30.20%	28.20%	2.70%	0.60%
≥5yrs(adult)	235	196	83.40%	59.20%	17.40%	2.10%	4.70%
Total	384	288	75.00%	47.90%	21.60%	2.30%	3.20%

CONCLUSION AND RECOMMENDATION

The present study indicated that, the gastrointestinal nematodes of camels in study recorded prevalence of 75.0%. The predominant GIT nematodes identified during coprological examination were Strongyles, Strongyloides, Trichuris and mixed nematode species. High prevalence in the study area might be due to poor management, improper deworming activity, lack of awareness and poor veterinary services in the area. As conclusion, gastrointestinal nematodes are affecting the health and productivity of camel either directly or indirectly. Therefore, further research on the epidemiology of the parasite and host related factors should be studied to develop prevention and control strategy of parasite at community level. In addition, public teaching or creating awareness with respect to the management and regular de-worming of camel at optimal time to prevent and control the disease in study area.

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