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Research Article

Prevalence and Associated Risk Factors of Major Gastrointestinal Nematodes of Cattle in Hawassa City

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Abstract

Gastrointestinal nematodiasis is a major constraint of livestock production causing huge economic loss to livestock sector of the country. A cross-sectional study aimed to assess prevalence of major gastrointestinal nematodes and associated risk factors was conducted from February, 2021 to November, 2021 in Hawassa city. In the study fecal samples were collected from randomly selected 384 cattle and coprological examination was employed by using floatation method. The study result revealed that the overall prevalence of major gastrointestinal nematodes in cattle was 20.3%. *Haemonchus* spp infection was found to be the most prevalent gastrointestinal nematode followed by *Trichostrongylus* spp, *Ostertagia* spp, *Nematodirus* spp, *Trichuris* spp and *Cooperia* spp. A significantly higher prevalence ($p < 0.05$) of infection with gastrointestinal nematodes was recorded in old (40.7%) than in adult (12.2%) and young (8.8%) animals. Sex-wise higher prevalence was recorded in female (27.9%) than male (12.3%) animals. Higher prevalence of gastrointestinal nematode infection was recorded in cattle having poor body condition. Mixed infection of *Haemonchus* spp. with *Trichostrongylus* spp (5.12%) was the most prevalent gastrointestinal nematodes co-infection followed by *Trichostrongylus* spp with *Nematodirus* spp (3.85%) and *Trichuris* spp with *Haemonchus* spp (3.85%). The effect of gastrointestinal tract nematodes in terms of loss of production, decreased growth rate, weight loss and death of animals in the present study cannot be neglected. Therefore, deworming and good pasture management should be practiced to mitigate the problem in the study area.

Keywords: Cattle; Coprology; Gastrointestinal nematode; Prevalence; Risk factor

INTRODUCTION

Ethiopia has the largest livestock population in Africa, having 69 million heads of cattle, 40 million heads of sheep, 51 million heads of goats, 8 million heads of camels and over 55 million of chicken [1]. Of the livestock, cattle constitute a major proportion and producing approximately 30% of local meat and milk supply, and revenue from meat and live animal export [2].

Even though cattle population provides such promising contribution for the country's economy, the contribution is not comparable to their potential productivity due to different detrimental factors that includes diseases such as gastrointestinal nematodiasis which have become very common and important constraints to cattle productivity [3].

Gastrointestinal nematodes are important parasites of cattle in tropics and subtropics causing loss of productivity and production due to reduced growth, weight loss, diminished intake and conversion of feed and water, low milk and meat production, and death of extensively parasitized young animals [4]. In addition, gastrointestinal nematodes of cattle cause clinical and sub clinical parasitism that is manifested by destruction of red blood cells, leading to unthrifty anemic condition resulted from mature worms, and bacterial and fungal complication due to immature migratory worms [5].

Livestock sector that includes beef and dairy cattle is experiencing negative economic impact worldwide as a result of nematode burdens. The negative impact is felt more in Africa in general and Ethiopia in particular due to the availability of a wide range of agro ecological factors suitable for survival and expansion of different types of helminthes including nematodes [6,7].

Haemonchus, Ostartagia, Trichostrongylus, Cooperia, Nematodirus, Oesophagostomum and Trichuris are known strongyle species that infect cattle worldwide causing detrimental effect on animal production and resultant loss in economic value of the animals [8]. Of strongyle species, *Ostartagia ostertagi, Haemonchus placei, Haemonchus contortus* and *Trichostrongylus axei* are commonest gastrointestinal nematode species of abomasum, whereas *Cooperia oncophora, Cooperia punctata, Nematodirus helvetianus, Trichostrongylus colubriformis, Oesophagostomum radiatum* and *Trichuris* spp are the commonest found in the intestine [9,10].

Body condition of host animal, age, sex, weather condition and animal husbandry or management practices are major risk factors that do influence the prevalence and severity of gastrointestinal nematode infection [11].

Furthermore, local environmental condition that includes humidity, temperature, rainfall and vegetation are important determinants for genera and species of nematode involved and severity of resultant infection [12].

Limited studies have been conducted in Hawassa city despite many studies having been conducted in different areas of Ethiopia to establish the prevalence and associated risk factors of gastrointestinal nematodes in cattle. Therefore, the study was carried out to identify the prevalence of gastrointestinal nematode infection and their associated risk factors in Hawassa city.

MATERIALS AND METHODS

Study area description

The study was conducted in Hawassa city, capital city of Sidama national regional state, located at 275 KM south of Addis Ababa. Geographically, the area lies between 40 27' and 80 30' N latitude and 340 21' and 390 1' E longitude. Average rainfall ranges from 800 to 1000 mm and the mean temperature ranges from 11.10 c to 29.10 c with the mean altitude of 1790 m above sea level. There are 1,573,318 cattles in the city that are managed both under intensive and extensive systems. Hawassa city has lacustrine type of soil, generally of medium to fine texture and alluvial soil with mainly clay, sand, and gravel. Short grasses and shrubs and to some extent eucalyptus, shola and exotic plants are the commonest vegetation [13].

Study population

Cattle that are managed under extensive and intensive management systems composed of exotic and local breeds constituted the study population. Both male and female; young, adult and old animals were represented. The study populations were 384 cattle. Of the cattle, 187 were males and 197 were females. In addition 113, 148 and 123 of the cattles were young, adult and old respectively.

Study design

A cross-sectional study was carried out from February, 2021 to November, 2021 using coproscopic examination. Age of the selected animals was categorized as young, adult and old based on dentition as described by Torell, et al. [14] and by asking the owner of the animals from which samples were collected. The body condition of

the selected animals was categorized as poor, medium and good body condition based on the description of Nicolson and Butterworth [15].

Sampling Method and Sample size Determination

Simple random sampling technique was used to select individual study animals. The sample size was determined according to the formula of Thrusfield [16]. Total sample size was calculated by considering 95% CL (Confidence Level), 5% desired level of precision and 50% expected prevalence of gastrointestinal tract nematode among cattle in the study area.

N= 1.962 Pexp (1-Pexp)

d2

Where,

N = required sample size

Pexp = expected prevalence

D = desired absolute precision

1.962 = Z-value for 95% confidence interval. Hence by using this formula, the sample size required for this study was 384 cattle.

Fecal sample collection and examination

The fecal samples were collected per rectum from selected animals using gloved hands. The collected samples were placed in plastic bottles and labeled with date, breed, age, sex and body condition of the individual animals. The samples were then sent to Hawassa University, Faculty of Veterinary Medicine, Parasitology laboratory in an ice box. The samples were processed and examined while fresh on the day of collection when conditions were conducive. Unprocessed samples were preserved in 10% Formalin. Data about age, sex, body condition and management was recorded upon observation or through interviewing animal owner. The samples were processed using the floatation technique as described by Urquhart, et al. [17]. NaCl (Sodium chloride) was used as a floatation fluid. Coproculture were carried out from samples that were positive for gastrointestinal nematode egg for identification of Strongyle species based on morphology of infective larvae (L3).

Data analysis and management

The data was entered and managed in Microsoft excel (Version 10). Data analysis was done by Statistical Package for Social Sciences (SPSS) software version 20. Descriptive statistics was performed on the data. The significance association between risk factors and prevalence of gastrointestinal nematodes were determined using chi- square (x2). The statistical association were said to be significant when the calculated *p*-value was less than 0.05 ($p < 0.05$).

RESULTS

Characteristics of study animals

Data on risk factors, including, sex, age, breed and body conditions was recorded. Out of 384 cattle examined, 51.3% were female and the remaining 48.7% were male animals. Similarly, 29.4%, 38.5% and 32.0% were young, adult and old respectively. On the other hand 56.5% of the cattle were local breeds while the rest 43.5% were exotic. In addition 34.9%, 35.4% and 29.7% of cattle examined were having poor, medium and good body condition, respectively (Table 1).

Prevalence of major gastrointestinal nematode infection

Out of 384 cattle examined, 78 (20.3%) were found positive and 306 (79.7%) were negative for gastrointestinal nematode. From 78 positive animals 68 (87.18%) animals were infected with single infection that consists of 6 genera of nematodes including Haemonchus (20.51%), Trichostrongylus (17.95%), Ostertagia (15.40%), Nematodirus (14.10%), Trichuris (12.82%) and Cooperia (6.40%) (Table 2).

Prevalence of mixed gastrointestinal nematode infection in cattle

Mixed gastrointestinal nematode infection was also observed. Accordingly, out of 78 positive animals, 10 (12.82%) animals had mixed gastrointestinal nematode infections. As a result, Haemonchus and Trichostrongylus, Trichostrongylus and Nematodirus and Trichuris and Haemonchus were 4 (5.12%), 3 (3.85%) and 3 (3.85%) were identified respectively (Figure 1).

Association of risk factors with prevalence of gastrointestinal nematodes

Associations of potential risk factors for the occurrence of gastrointestinal nematodes are represented on the tables below. Accordingly, there was a significant association ($p < 0.05$) in the prevalence of gastrointestinal nematodes between sex, age and body condition. There was no significant association between breed of the animals and prevalence of gastrointestinal nematodes.

Association of sex with prevalence of gastrointestinal nematodes in cattle

There were significant association between sex of cattle and prevalence of gastrointestinal nematodes. Accordingly, from positive cattle, 27.9% were females and 12.3% were males (Table 3).

Table 1: Characteristics of study animals.

Variable		Frequency	Percentage (%)
Sex	Female	197	51.3
	Male	187	48.7
Age	Young	113	29.4
	Adult	148	38.5
	Old	123	32.0
Breed	Local	217	56.5
	Exotic	167	43.5
Body condition	Poor	134	34.9
	Medium	136	35.4
	Good	114	29.7

Table 2: Prevalence of single gastrointestinal nematode infection in cattle.

Nematode type	No of positives	Percentage (%)
Haemonchus	16	20.51
Trichostrongylus	14	17.95
Trichuris	10	12.82
Ostertagia	12	15.40
Nematodirus	11	14.10
Cooperia	5	6.40
Total	68	87.18

Association of age with prevalence of gastrointestinal nematodes in cattle

Age of the cattle has significant association with prevalence of gastrointestinal nematodes in cattle. As a result, from positive cattle, 40.7%, 12.2% and 8.8% were old, adult and young respectively (Table 4).

Association of breed with prevalence of gastrointestinal nematodes in cattle

There were no significant association between breeds of cattle and prevalence of gastrointestinal nematodes found. Of positive cattle, 23.5% and 16.2% were local and exotic breeds respectively (Table 5).

Association of body condition with prevalence of gastrointestinal nematodes in cattle

There were significant association between body conditions of cattle and prevalence of gastrointestinal nematodes. Accordingly, from positive cattle, 40.3%, 10.3% and 8.8% had poor, medium and good body conditions respectively (Table 6).

DISCUSSION

Gastrointestinal nematodes are a major health problem of livestock that hinders effective production in the livestock sector. In order to mitigate the impact, knowing the status of such parasite by using different diagnostic method is important. In the current study, out of 384 cattle examined, 20.3% were tested positive for gastrointestinal nematode. This was in line with earlier reports by

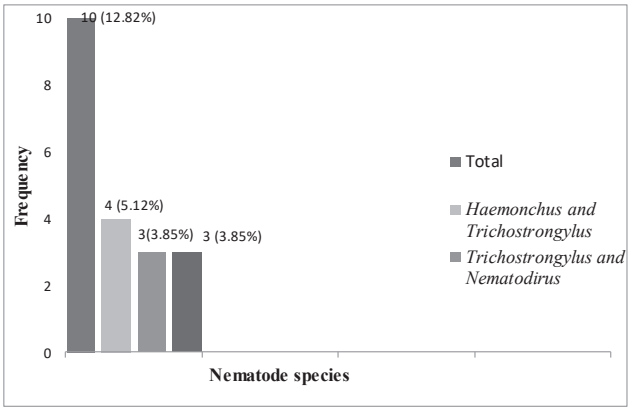

Figure 1: Prevalence of mixed gastrointestinal nematodes in cattle.

Table 3: Association of sex with prevalence of gastrointestinal nematodes in cattle.

Sex	No of cattle examined	No of positive cattle (%)	X^2	*p*- value
Female	197	55 (27.9%)	14.459	0.00
Male	187	23 (12.3%)		

Table 4: Association of age with prevalence of gastrointestinal nematodes in cattle.

Age	No of cattle examined	No of positive cattle	X^2	*p*- Value
Young	113	10 (8.8%)	46.678	0.00
Adult	148	18 (12.2%)		
Old	123	50 (40.7%)		

Table 5: Association of breed with prevalence of gastrointestinal nematodes in cattle.

Breed	No of cattle examined	No of positive cattle	X^2	*p*-Value
Local	217	51 (23.5%)	3.137	0.077
Exotic	167	27 (16.2%)		

Table 6: Association of body condition with prevalence of gastrointestinal nematodes in cattle.

Body condition	No of cattle examined	No of positive cattle	X^2	*p*-Value
Poor	134	54 (40.3%)	50.903	0.00
Medium	136	14 (10.3%)		
Good	114	10 (8.8%)		

Tigist, et al. [18] that reported 27.57% prevalence in Gondar District in northern Ethiopia. However, higher prevalence about 41.5%, 82.2% and 97.2% have been reported elsewhere by Muktar, et al. [19] in Diredawa, Etsehiwot [20] in central Ethiopia and Keyyu, et al. [21] in Tanzania respectively. The variation can be explained by differences in local environmental conditions such as humidity, temperature, rainfall, vegetation cover and management practices of cattle owners. In addition differences could be attributed to the topography and deworming practices [22].

In this study, 87.18% cattle were found infected by single gastrointestinal nematode species. Correspondingly, Abdulkadir, et al. [23] has reported 83.75% infection with single gastrointestinal nematode species. Higher prevalence of single gastrointestinal nematodes might be due to competition of nematodes with each other for the predilection site and nutrition within the host which in turn prevent survival of two or more nematodes in the same predilection site. The fittest nematode survives and continues its life cycle in the gastrointestinal tract of the host [2].

On the other hand, 12.82% of the cattle were found infected with mixed gastrointestinal nematodes. In line with this, Abdulkadir, et al. [23] in and around Kombolcha and Dessie town have reported a prevalence of 16.25%. However, higher mixed gastrointestinal nematode infections were reported by Bacha and Haftu [24] in Arsi Zone (42.02%). In addition, lower prevalence of mixed infection (6%) was also reported by Shirale, et al. [25]. Such differences in prevalence of mixed infection could be due to high resistance of the host to different nematodes or deworming practices of the study areas [2].

In the present study, from major gastrointestinal nematodes, Haemonchus were the highest prevalent nematode species with 20.51%. In line with this finding, Kabaka, et al. [26] reported higher prevalence of Haemonchus (28.1%) in Nakuru and Makurweini districts of Kenya. In contrast to this study, lower prevalence of Haemonchus was reported by Abdihakim [2] in Mekele, northern Ethiopia with a prevalence of 1.66%. The difference on the prevalence of this parasite might be due to difference in resistance of the cattle to the parasite, agro ecology and distribution of the parasite or deworming activities with broad spectrum anthelmintics [27].

Likewise, higher prevalence of mixed infection was observed between Haemonchus and Trichostrongylus (5.12%). This result was in agreement with the finding of 6.4% by Adem and Anteneh [28] on Haramaya University dairy farm.

In the current study, Cooperia were the least prevalent with 6.4%.

In line with this, low prevalence of Cooperia (6.7%) was reported by Ameen, et al. [29] in Nigeria, Oyo state. In addition, lower prevalence of Cooperia with a prevalence of 4.43% and 0.43% were reported by Belina, et al. [4] in Dire Dawa District, and Gelaye and Fesseha [30] in Guangua District, Awi zone respectively.

A significant difference ($p = 0.00$) was observed in the prevalence of nematodes among the age groups. Accordingly, older animals were more affected (40.7%) followed by adult (12.2%) and young (8.8%). Likewise, Gelaye and Fesseha [30] reported higher prevalence of 60.67% in old animals. This increase in the prevalence with age could be due to increase in frequency of contact with the parasite at the time of grazing, reduction in immune activity of the cattle as age increases and different management system for different age groups [24].

Lower prevalence of gastrointestinal nematodes (8.8%) was found in young cattle. Correspondingly, Abdulkadir, et al. [23] was reported lower prevalence in young animals when compared with other age groups. Lower prevalence of gastrointestinal nematodes in young animals might be due to grazing habit. As a common practice, young animals are allowed to graze around farms rather than trekking long distance to valleys or swampy areas which in turn prevent young animals from exposure to contaminated pastures [31].

Current study revealed that, there was a significant relation ($p = 0.00$) between sex of animals and occurrence of gastrointestinal nematodes. Higher prevalence was recorded in female animals (27.9%). Correspondingly, Abdulkadir, et al. [23] was found higher prevalence of gastrointestinal nematodes in females (47.5%). High prevalence of gastrointestinal nematodes in female cattle may be due to difference in exposure as a result of stocking density (sex ratio) and stress due to pregnancy and lactation in female animals that result in survival and sustainability of nematodes in the gastrointestinal tract [23,32].

On the other hand lower prevalence (12.23%) of gastrointestinal nematode was found in males. In line with this, Abdulkadir, et al. [23] was found a prevalence of 35.3% in male cattle in Dessie and Kombolcha towns. The reason behind low prevalence of gastrointestinal nematodes in male might be due to most of the time males fed confined in the house for fattening purpose which results in less exposure to contaminated pasture and minimal changes on their physiology [33].

In addition, according to the present study a significant difference ($p = 0.00$) was observed in prevalence of gastrointestinal nematodes between animals with different body condition. Accordingly, high prevalence was recorded in animals with poor body condition (40.3%) than medium (10.3%) and good body condition (8.8%). In agreement with the present study, Diriba and Tulu [34] were found a prevalence of 31.7%, 38.2% and 51.9% in cattle with good, medium and poor body condition respectively. Prevalence of gastrointestinal nematodes is high in cattle with poor body condition because their immunity does not suppress the fecundity of gastrointestinal nematodes [35]. Prevalence of gastrointestinal nematodes is low in cattle with good body condition because well- fed animals develop a good immunity that prevent the survival, growth and multiplication of nematodes in the gastrointestinal tract [7].

CONCLUSION AND RECOMMENDATIONS

Gastrointestinal nematodes are important health problems of cattle in the study area. Normally, causing economic impact, including, reduction in milk and meat production, decrease in selling value of the animals and loss of the affected animals with death. Among the nematode genera identified, Haemonchus was found to be the most prevalent parasite whereas Cooperia was the least prevalent gastrointestinal nematode in the study area. Mixed infection of different gastrointestinal nematode was also identified. Important risk factors that were significantly associated with prevalence of gastrointestinal nematode infections included sex, age and body condition. The Breed of the cattle didn't show statistical association with the prevalence of gastrointestinal nematode. Nevertheless, the effect of gastrointestinal tract nematodes in the present study cannot be neglected due to associated loss of production, decreased growth rate, weight loss and death of animals.

In conclusion, we recommend the following:

- Practicing of regular deworming of cattle against gastrointestinal nematodes.
- Good management of grazing pasture to minimize pasture contamination.
- Further researches should be conducted in order to provide more information about gastrointestinal tract nematodes in cattle to allow designing of appropriate control and preventive measures.

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Conflict of Interest

The authors declare that there was no conflict of interest.

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