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Original Research

Study on Prevalence and Related Factors of Gastrointestinal Nematodes in Cattle in Wombera Town, Benishangul-Gumuz Regional State, Western Ethiopia

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Abstract

Due to its numerous negative effects on animal health and productivity, parasitic disease in ruminants, especially in animals of economic significance is a serious problem. A cross-sectional study examined cattle's incidence and risk variables of gastrointestinal nematode parasitism between November 2021 and May 2022. Using flotation analysis, 384 fecal samples from cattle of multiple ages and sexes were tested for gastrointestinal nematode eggs. Among them, Ostertagia spp. 12 (3.1%), Oesophagostomum spp. 8 (2.1%), Strongyloid spp. 15 (3.9%), Trichostrongylus spp. 18 (4.7%), Haemonchus spp. 64 (16.7%), Bunostomum spp. 27 (7%), and Trichuris spp. 15 (3.9%) were among the 159 (41.4%) animals that revealed a single type of intestinal nematode was detected. Compared to calves (21.5%) and young animals (44.2%), the prevalence of gastrointestinal nematode infection was significantly greater in adult animals (48%) ($P < 0.05$). There was no significant difference in intestinal nematode incidence between the sexes ($p > 0.05$). The study animals' body conditions varied widely ($P < 0.05$), with the majority (58.3%) having poor body conditions, followed by medium (38.2%) and good (32.2%). Important threat factors for gastrointestinal nematodes in the study area in this paper are the animal's age, gender, and physical condition.

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INTRODUCTION

Ruminant parasitic disease is a major issue, particularly in commercially significant animals, because it has a variety of consequences for animal health and production. Gastrointestinal nematodes primarily cause ruminant infections. Intestinal parasite disorders generate various characteristics and problems, ranging from moderate to serious, contingent upon the parasite's species, disease progression, invasive or non-invasive, and pathogen quantity (Wangboon et al., 2024). The *Strongyle* nematodes are classified into the *Strongylidae* family, including the *Trichostrongylus, Haemonchus, Ostertagia, Cooperia, Nematodirus, and Oesophagostomum.* (Yonas et al., 2018; Hailu et al., 2022). Despite the use of anthelmintic, the quantity of instances has not significantly decreased as a result of drug

abuse and usage, resulting in drug resistance (Lazo et al., 2024).

One of the most significant agricultural products is cattle, which is regarded as a source of protein for all living creatures, particularly people, to meet their nutritional demands throughout their lives (Zulfikar et al., 2019). Cattle are raised by farmers on a small or large scale, both intensively and traditionally. The demands mentioned above are difficult for some parts of the global cattle business to meet, especially regarding health problems that result in low productivity and output. The presence of worm parasites, like the nematode worm, that infect livestock is one of the health problems. On farms in less developed countries with inadequate health management, this issue is common. Production will be impacted by poor animal health (Mramba & Mapunda, 2024).

Nematodes, often referred to as roundworms, are a broad group of rather simple organisms that are widely dispersed; they differ from other helminths in that they have cylindrical, non-segmented bodies. They are among the most successful parasites of plants and animals, and they flourish in freshwater, marine environments, and the earth. Both numerous parasitic species and the vast majority of free-living nematodes enter bodily fluids like blood or lymph arteries. While some species in tissue (the kidney) can grow to enormous lengths, these in the intestine are typically larger (Abera et al., 2023). In domestic animals from all around the world, the prevalence of gastrointestinal helminths has been found to vary between 0.7 and 84.1%. Numerous risk variables affect the frequency of gastrointestinal worms, such as ageing, gender, meteorological conditions, and farming or control methods (Molento et al., 2016). Given that the majority of studies on the prevalence and circulation of gastrointestinal nematodes in Ethiopia have been carried out in the central and northern highlands as well as semi-arid regions of Eastern Ethiopia, little is known about the incidence and geographic spread of gastrointestinal worms infecting cattle in the study area. The current study's objectives were to identify the main risk factors associated with the incidence of gastrointestinal nematode infection in cattle, assess the prevalence of gastrointestinal nematode parasites in and around Wombera town, provide baseline data for future research, and make some important recommendations for the control of parasitic infections in the study area.

MATERIALS AND METHODS

Study Area

The research was carried out from November 2021 to May 2022 in Wombera town, Metekel Zone, Benishangul Gumuz Regional State, approximately 653 km northwest of Addis Abeba, Ethiopia. Geographically, it lies between latitude 10°29'59.99" N and longitude 35°24'59.99 E. It is bordered by the Amhara region in the northeast and the Oromia regional state in the southwest, as well as the Nile River in the north. The entire area of the woreda is around 7464.25 km². The woreda experiences two distinct seasons of rainfall: the short-wet season, which lasts from February to April, and the main rainy season, which lasts from July (June to August). The amount of precipitation ranges between 900 and 1740 millimeters. The woreda has a typical yearly rainfall of 1320 millimeters. The average temperature is 18°C (NMSA, 2021). The overall number of livestock in the woreda is estimated to be

83,849 cattle, 60,497 sheep, 10,253 goats, 15,521 horses, 9,155 donkeys, 2,157 mules, and 71,435 poultry (Getnet et al., 2024). The study area is described in (Figure 1) below.

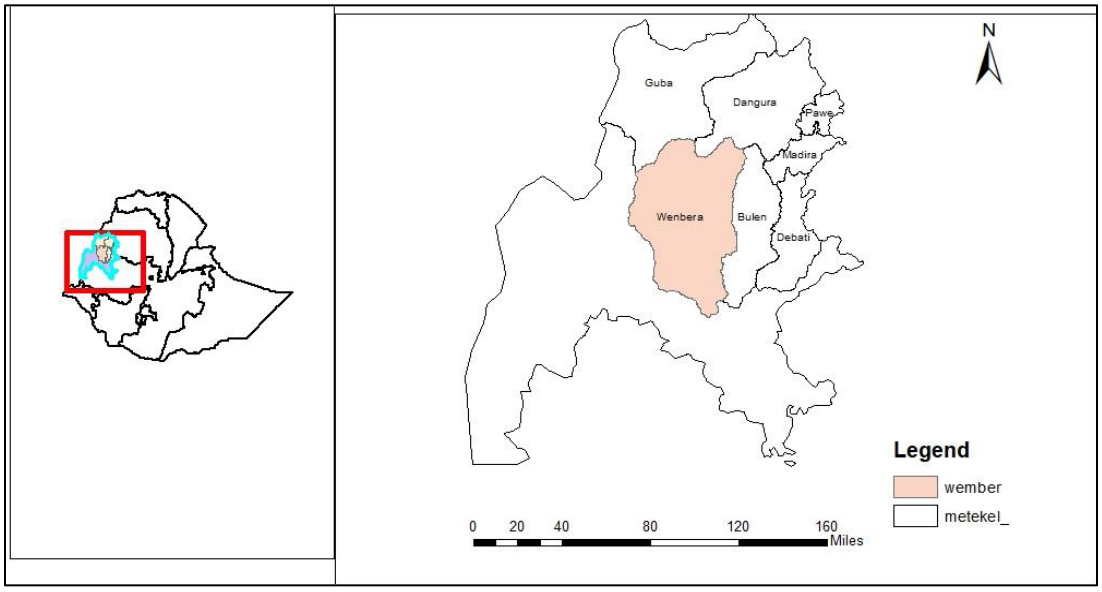


Figure 1. *Map of the study area*

Study Animals

The research included 384 cattle of both sexes (male and female), native breeds, and all ages. The state of the body was scored and classified as poor, medium, or good (Morgan, 2006). In the absence of written records, the age of the animal was calculated according to the holders' responses and the tooth pattern of the animal. Animals have been divided into 3 age categories: calf (<1 year), young (1-3 years), and adult (>3 years) (Gelaye & Fesseha, 2020).
Study Design

A longitudinal study design was used to estimate the frequency of gastrointestinal bovine helminth worms over the study period, as well as to analyse the primary determinants impacting animal incidence of infection.

Sampling and Sample Size Calculation

Applying sample selection at random to choose study animals. The Kebele was chosen specifically for its proximity to Wombera town and ease of transit. To calculate the sample size, an estimated 50% probability was used because no previous studies had been undertaken in the study area. The appropriate sample size for the investigation was estimated utilising the provided calculation, with a 95% confidence interval and a 5% absolute accuracy (Thrusfeld, 2018).

Therefore, according to the equation provided

$$n = \frac{(1.96)^2 P_{exp}(P_{exp} - 1)}{d^2} = 384$$

Where d^2 is the desired absolute precision, Pexp is the expected prevalence, n is the necessary sample size, and 1.96 is the value of z at the 95% confidence level. Thus, 384 cattle in all were required for the research.

Study Methodology

Fecal Sample Collection

During the investigation, 384 cattle were sampled, and fecal material can be encountered in each glove on the rectum. Fecal material was collected from each animal and placed in fecal sample bottles labelled for different ages, sexes, and origins. The bottles were kept cool before being transported to the Woreda veterinary clinic, where the sample was checked right away or kept for no more than a day at 4°C before preparation.

Parasitological Technique

The sample was treated using standard flotation procedures to analyse helminth parasite eggs (Terfa et al., 2023). A statistically significant association was defined as a p-value of less than 0.05.

Data Analysis

The data and information acquired on cattle gastrointestinal worms throughout the time were entered into a Microsoft Excel worksheet, and software version 20 of SPSS was used for the study. The frequency was determined using percentages. The importance of the relationship among the parameters was established using p-value and chi-square test statistics.

RESULTS AND DISCUSSIONS

Results

The prevalence of gastrointestinal nematode infections was 41.4%, based on the coprological analysis of 384 fecal samples.

Rate of intestinal nematodes in various age and sex categories

Three age groups for animals have been established. They were adults, young ones, and calves. The total number of animals examined was 179 calves, 122 young cattle, and 183 adult cattle. A total of 88 (48%) adult cattle, 54 (44.2%) young cattle, and 17 (21.5%) calves tested positive for gastrointestinal nematodes.

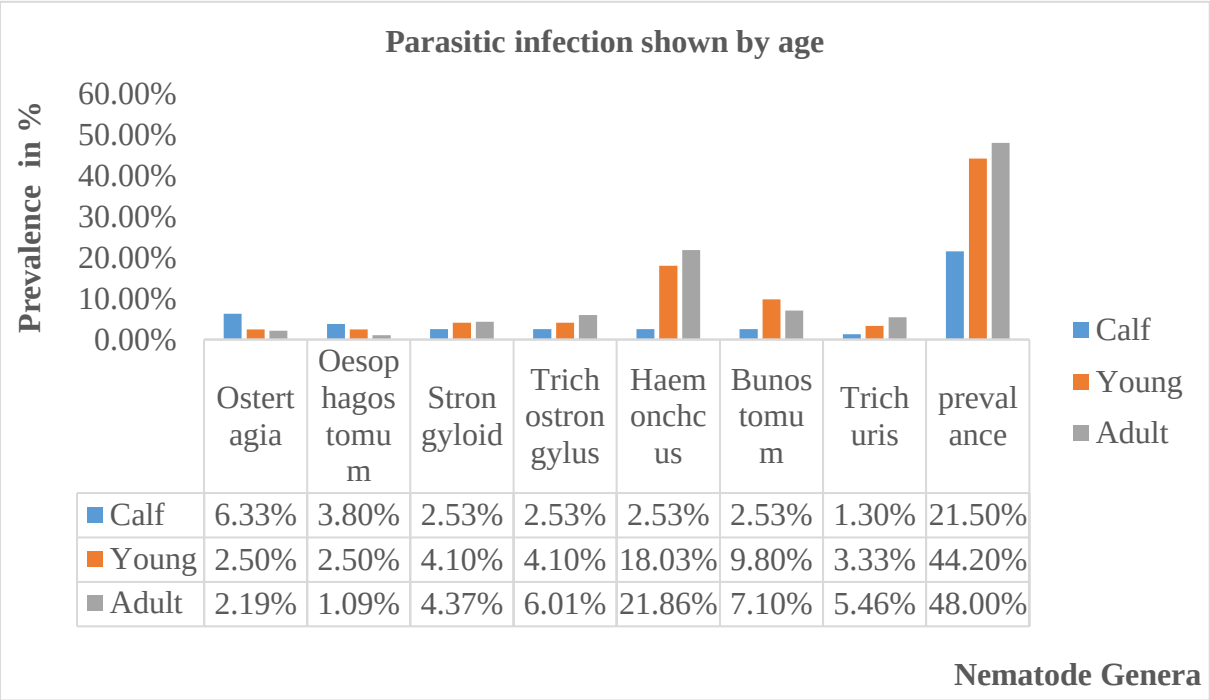
Table 1

Infection percentage with intestinal parasites of cattle based on age and sex

Age	Number of examined animals	Number of Positive animals	Prevalence (%)	X^2	P-value
Calf	79	17	21.5		
Young	122	54	44.2		
Adult	183	88	48	7.5	0.023
Total	384	159	41.4		
Sex					
Male	176	85	48		
Female	208	74	36	0.08	0.71
Total	384	159	41.4		

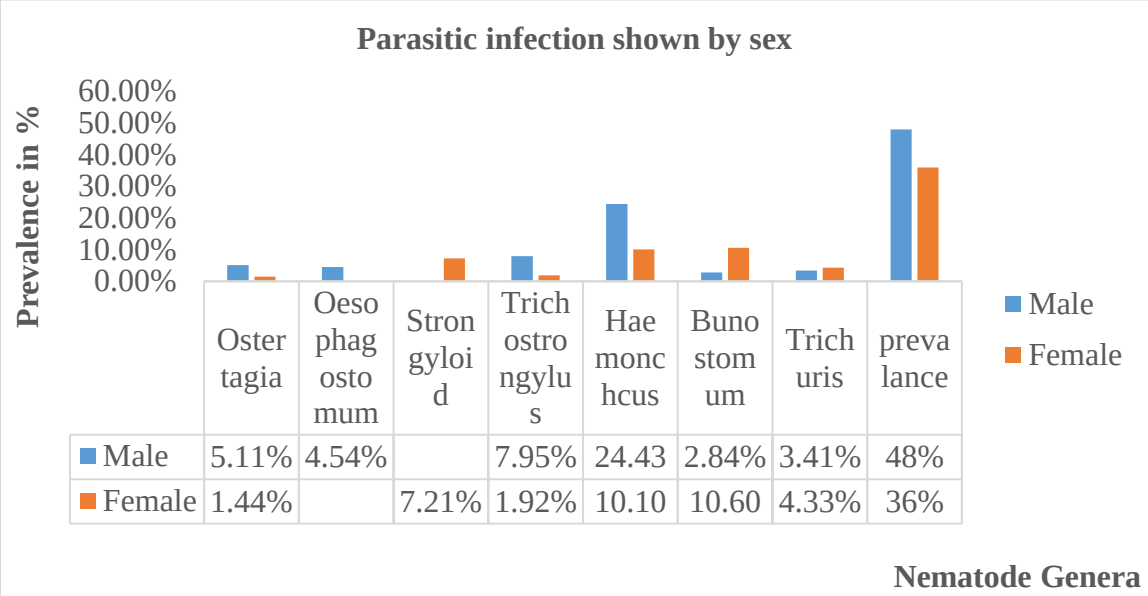
A substantial correlation ($P < 0.05$) exists between age and parasite infestation. Older animals have higher parasite prevalence, presumably due to increased exposure to risk factors. Intestinal parasite occurrence in the present work was not sex-dependent. That is, the association between the incidence of parasites and animal sex is not statistically

significant (P = 0.71). Both sexes in this district may be under the same management and environmental conditions. 176 of the 384 animals that were tested were male, while the remaining 208 were female. 74 (36%) of the 208 female animals and 85 (48%) of the 176 male animals that were examined tested positive for gastrointestinal nematodes (Table 1; Figure 2 and Figure 3).



	Ostertagia	Oesophagostomum	Strongyloid	Trichostrongylus	Haemonchcus	Bunostomum	Trichuris	prevalance
Calf	6.33%	3.80%	2.53%	2.53%	2.53%	2.53%	1.30%	21.50%
Young	2.50%	2.50%	4.10%	4.10%	18.03%	9.80%	3.33%	44.20%
Adult	2.19%	1.09%	4.37%	6.01%	21.86%	7.10%	5.46%	48.00%

Figure 2. *Age-dependent rate of intestinal parasitic infection*



	Ostertagia	Oesophagostomum	Strongyloid	Trichostrongylus	Haemonchcus	Bunostomum	Trichuris	prevalance
Male	5.11%	4.54%		7.95%	24.43	2.84%	3.41%	48%
Female	1.44%		7.21%	1.92%	10.10	10.60	4.33%	36%

Figure 3. *Sex-based frequency of intestinal helminth parasite infection*

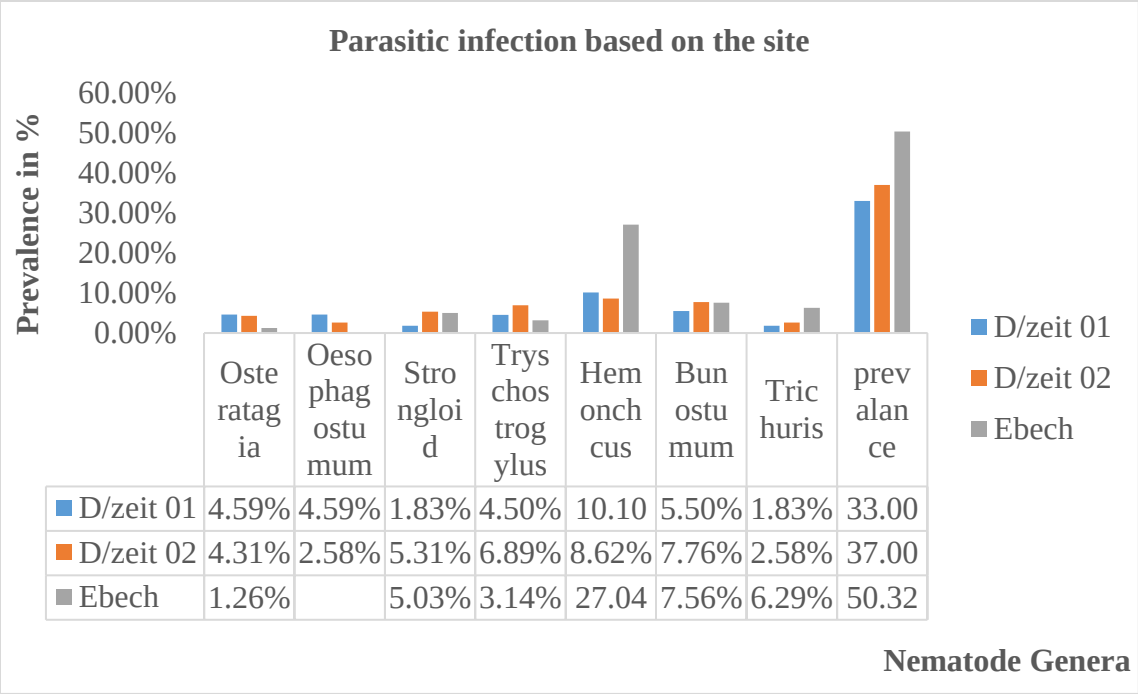
Gastrointestinal nematode prevalence in different Kebele

The frequency of intestinal parasites in the digestive tract varies significantly (P = 0.013) among the Kebeles in the study area, with the highest infection (50.3%) in Ebech Kebele, followed by Debre Zeit 02 (37%), and the lowest infection (33%) in Debre Zeit 01 Kebele. The discrepancy observed among these Kebeles may be ascribed to variations in the accessibility of common areas for grazing and watering, as well as temperature variances. It was estimated that 41% of the animals in Ebech Kebele, 30% in Debre Zeit 02 Kebele, and 28% in Debre Zeit 01 Kebele had access to communal watering and grazing (Table 2 and Figure 4).

Table 2

Based on origin, the rate of intestinal parasitic disorders

Study Site	Number of Examined animals	Number of Positive animals	Prevalence (%)	X^2	P-value
Debre Zeit 01	109	36	33		
Debre zeit 02	116	43	37	15.32	0.013
Ebech	159	80	50.3		
Total	384	159	41.4		



	Osteratagia	Oesophagostumum	Strongloid	Trychostrogylus	Hemonchcus	Bunostumum	Trichuris	prevalance
D/zeit 01	4.59%	4.59%	1.83%	4.50%	10.10	5.50%	1.83%	33.00
D/zeit 02	4.31%	2.58%	5.31%	6.89%	8.62%	7.76%	2.58%	37.00
Ebech	1.26%		5.03%	3.14%	27.04	7.56%	6.29%	50.32

Figure 4. *Prevalence of Gastrointestinal nematode parasite infection shown by Keble*

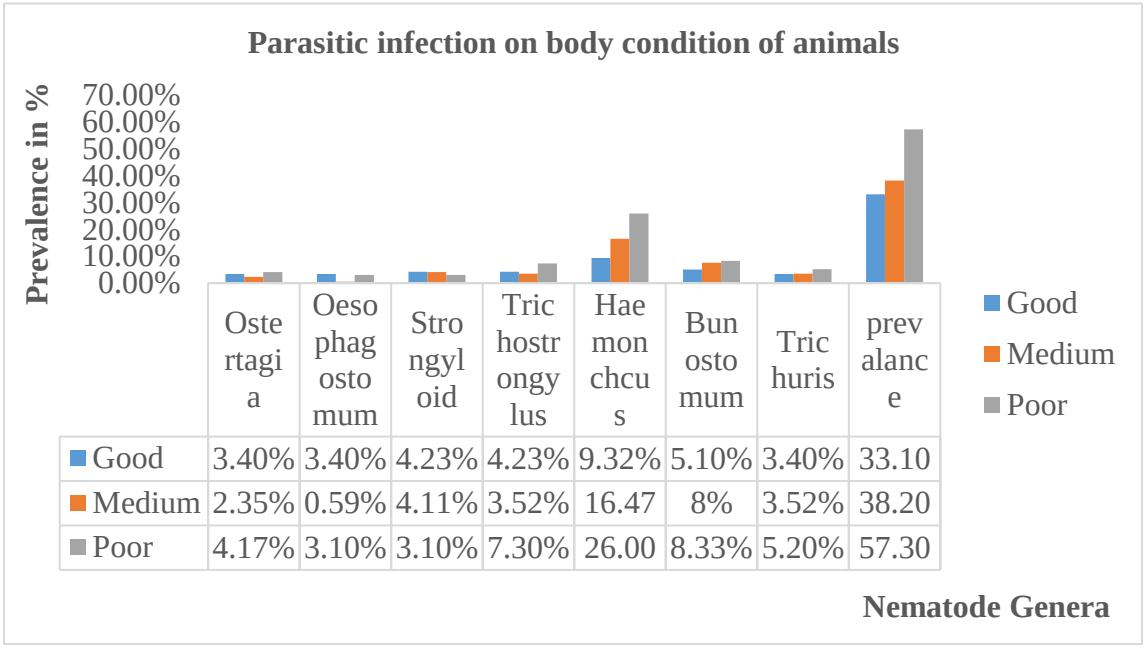
Frequency of intestinal parasites in various physiological states

The physical conditions of the animals were also considered throughout the assessment, and they were divided into three groups. Good, medium, and poor were the three alternatives. 384 animals were examined; 118 of them had good body condition; 39 (32.1%) of the animals tested positive for gastrointestinal nematodes; 170 had medium body condition; 65 (37.2%) of the animals tested positive; the remaining 96 had poor body condition; of these, 55 (57.3%) tested positive for parasitic nematodes. This result suggests that there is a significant correlation between body condition and body condition score (P = 0.001). This implies that an animal's health and the existence of gastrointestinal parasites are strongly correlated. The blood-sucking trait of gastrointestinal parasites in cattle may be the cause of this discovery (Table 3 and Figure 5).

Table 3

Infection of gastrointestinal parasites within different body conditions

Body condition score	Number of Examined animals	Number of Positive animals	Prevalence (%)	X^2	P-value
Good	118	39	32.1	52.3	0.001
Medium	170	65	38.2		
Poor	96	55	57.3		
Total	384	159	41.4		



	Oste rtagi a	Oeso phag osto mum	Stro ngyl oid	Tric hostr ongy lus	Hae mon chcu s	Bun osto mum	Tric huris	prev alanc e
Good	3.40%	3.40%	4.23%	4.23%	9.32%	5.10%	3.40%	33.10
Medium	2.35%	0.59%	4.11%	3.52%	16.47	8%	3.52%	38.20
Poor	4.17%	3.10%	3.10%	7.30%	26.00	8.33%	5.20%	57.30

Figure 5. *Based on physical condition, the incidence of intestinal helminth parasite infection*

Level of disease with intestinal parasites identified

159 of the 384 animals that were examined had gastrointestinal nematode infections, yielding a 41.4% overall incidence rate. These infections include *Ostertagia* spp. 12 (3.1%), *Oesophagostomum* spp. 8 (2.1%), *Strongyloid* spp. 15 (3.9%), *Trichostrongylus* spp. 18 (4.7%), *Haemonchus* spp. 64 (16.7%), *Bunostomum* spp. 27 (7%), and *Trichuris* spp. 15 (3.9%). *Oesophagostomum* species had the highest incidence of gastrointestinal parasite infestations, while *Haemonchus* spp. were the most often reported gastrointestinal nematode infestations in the current analysis (Figure 6).

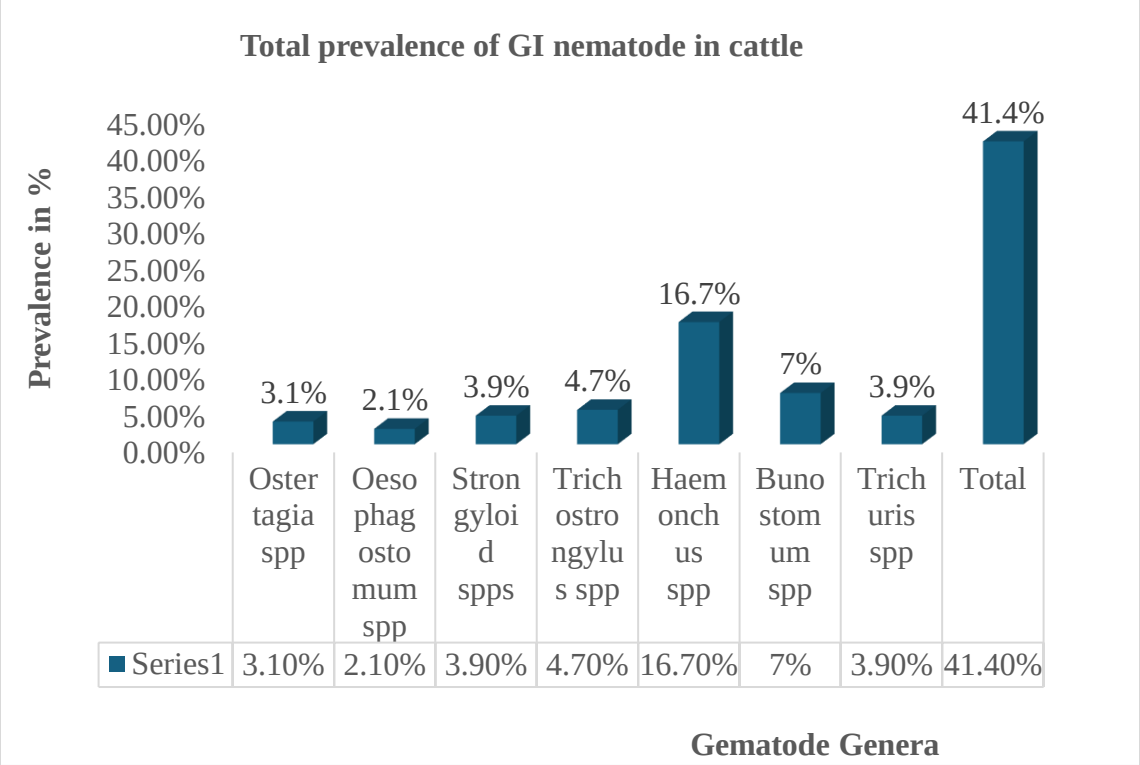


Figure 6. *Prevalence and identification of specific genera of nematodes*

DISCUSSION

Parasitic diseases pose among the most significant obstacles to international cattle farming. The largest prevalence of parasite diseases has been recorded in temperate and tropical countries, especially in Russia, Africa, Asia, Australia, and Eastern Europe, with factors such as climate, diet, and poor sanitation (Tiele et al., 2023). The current investigation discovered that 41.4% of cattle had gastrointestinal nematode infections. This - is in line with the results of Muktar et al. (2015), 41.4% of Dire Dawa; Bacha and Haftu (2014) in the West Arsi Zone with 49%; Usman and Bilal (2022) in and around Hirna town, Tullo District, Oromia regional state, 43%; and Regea (2019) in Jimma Town, Oromia, South Western Ethiopia, 46.7%, respectively. There may be similarities in study design and animal management.

The current prevalence was slightly lower than several study outcomes recorded in different parts of Ethiopia, including 71% in

Assella (Lemma & Abera, 2013), 67.2% in and around Hosanna Town (Tiele et al., 2023), 61% in East Showa Zone (Telila et al., 2014), 56.9% in Borana Zone (Teshome et al., 2023), 51.3% in selected districts of East and Western Hararghe (Belina et al., 2017), and 55.61% in Pakistan (Pakhtunkhwa, 2023). The greater incidence seen in various regions of Ethiopia could be attributed to excessive stock, shortage of feed, inappropriate livestock management methods, and frequent contact with contaminated communal grazing pastures.

The present study finding is higher than the 27.57% recorded in Gondar (Tigist et al., 2015), 31.2% in the West Hararghe Zone's Tullo woreda (Fulasa & Berhanu, 2020), 33.3% in Thailand (Wangboon et al., 2024), and 31.2% in Aceh Province of Indonesia (Zulfikar et al., 2019). This discrepancy in prevalence between study areas could be attributed to differences in management procedures, geography, deworming techniques, sample number, survey season variance, as well as ecological circumstances that encourage the parasite's invasive stage to persist.

The study found a strong correlation between numerous risk variables such as age, place of origin, and animal physical condition score. Furthermore, the role of nematodes was determined to be stronger in adults (48%) than in young (44.2%) and calves (21.5%) via flotation. This parallel increase in occurrence with animal age could be attributed to a rise in the number of interactions with age as well as management variables (Gelaye & Fesseha, 2020).

The prevalence of gastrointestinal nematodes fails to vary significantly by sex. However, it is 48% greater in males than in females (36%). This report was similar to previous findings from the West Arsi zone (Bacha & Haftu, 2014), which found a prevalence rate of 52.2% in males and 46.7% in females, and North West Ethiopia's Guangua District, Awi Zone, Amhara Region (Gelaye & Fesseha, 2020), with 56.3% in males and 53.05% in females, respectively. This is because males are more likely to graze and plow than females.

There is a notable variation in the number of cases of intestinal parasites by origin (P-value = 0.013). Despite this, among the three, the study sites Ebech (50.32%) and Debre Zeit 02 (37%) were where intestinal parasites became predominant and less prevalent in Debre Zeit 01 (33%). The disparity might result from people's increased knowledge of their animals, and the location of veterinary drug access was centred on Debre Zeit 01. Almost all urban farmers use intensive management systems, whereas farmers in rural areas use extensive systems. Furthermore, urban farmers have access to anthelmintic medications and are more conscious of the significance of deworming than rural farmers. This was consistent with the previously conducted study (Muktar et al., 2015; Usman & Bilal, 2022).

The present study also found that the animal's bodily state had a strong relationship with the presence of parasites. Poor-body-condition animals are more common than medium- and good-body-condition animals (58.3%, 38.2%, and 32.2%, respectively). This study's prevalence in body conditions is in line with the research carried out in different parts of the country (Abera et al., 2023; Usman & Bilal, 2022; Regea, 2019). As a result, the change in body condition could indicate that

the animals had been infected with gastrointestinal nematodes. Animals with poor physical health have limited immunity to parasites and other infectious diseases.

The current investigation found a varying proportion of nematodes from various taxa. *Haemonchus spp*. (16.7%) was the most common, followed by *Bunostomum spp*. (7%). However, *Oesophagostomum spp*. accounts for 2.1%. Aside from our findings, the most commonly encountered nematodes were *Haemonchus* and *Bunostomum*, with *Oesophagostomum* appearing less frequently. This agrees with the reports of Khan et al. (2023) and Terfa et al. (2023). It appears that these commonalities could be attributed to the study areas' similar agroecology as well as their management strategies.

CONCLUSIONS

The total number of cases of digestive tract helminth parasitic organisms in the research area suggested intestinal helminthiasis is a severe disease caused by its elevated frequency and parasitism. The study area has a high nematode infection rate; thus, stakeholders should regulate and treat these animals. As a result, the study area is susceptible to health issues caused by gastrointestinal helminthiasis, which may affect economic output from cattle production. Based on these observations, the following recommendations are given:

- *Veterinarians should provide competent assistance in preventing and controlling gastrointestinal helminth infections.*
- *Improve management and feeding conditions for cattle in the area.*
- *Strategic treatment and awareness creation are necessary, as cattle rearing is already a source of income.*
- *Additional research is needed to gain a better understanding of gastrointestinal parasites in the study area and implement effective control and prevention strategies.*

CRediT authorship contribution statement

The author confirms the sole responsibility for the conception of the study, presented results and manuscript preparation.

Declaration of competing interest

The author declares that there is no conflict of interest.

Data availability

The data used in this research is available upon request.

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