

Assessment of The Prevalence and Associated Risk Factors of Gastrointestinal Parasite Of Goats In Afgooye District, Lower Shabelle, Somalia

Penilaian Prevalensi dan Faktor Risiko Terkait Parasit Gastrointestinal Kambing di Distrik Afgooye, Shabelle Bawah, Somalia

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ABSTRACT

Background: Gastrointestinal parasitic diseases remain an obstacle to goat farmers in Somalia and worldwide. **Purpose:** This study aimed to determine the prevalence and associated risk factors of gastrointestinal parasites in goats in the Afgooye district, Lower Shabelle region, Somalia. **Methods:** To fulfill this study, an examination of 384 fecal samples of goats kept by smallholders was conducted. The results were achieved during the period from August 2020 to January 2022. **Results:** The examination of fecal samples revealed that the overall prevalence of gastrointestinal parasitic infections among goats was 71.61%. The data analysis conducted during the study indicated that there is no significant association ($p > 0.05$) between goat districts and gastrointestinal (GI) parasite infection. The corresponding percentage of gastrointestinal parasites in males and females was 70% and 72%, respectively. However, these variables were not significantly associated (p -value = 0.399). After categorization, age was not significantly associated with the parasitic infection status of the animal. The common parasitic infections prevalent were Nematode, Trematode, Cestode, and Protozoa types were found in different numbers. According to the flotation and sedimentation techniques, *Eimeria sp.* (29%) was found with higher prevalence followed by *Haemonchus sp.* (23%), *Trichostrongylus sp.* (11%), *Moniezia sp.* (10%), *Trichuris sp.* (9%), *Strongyloides sp.* (7%), *Dictyocaulus sp.* (5.2%), *Nematodirus sp.* (4%), and least was *Fasciola sp.* (1.0%). **Conclusion:** This study provides comprehensive documentation on multiple GI parasites among goats in the Afgooye district, Lower Shabelle region of South-western State, Somalia.

ABSTRAK

Latar Belakang: Penyakit parasit gastrointestinal tetap menjadi hambatan bagi peternak kambing di Somalia dan di seluruh dunia. **Tujuan:** Penelitian ini bertujuan untuk mengetahui prevalensi dan faktor risiko terkait parasit gastrointestinal pada kambing di distrik Afgooye, wilayah Shabelle Bawah, Somalia. **Metode:** Untuk memenuhi penelitian ini, dilakukan pemeriksaan terhadap 384 sampel feses kambing yang dipelihara oleh petani kecil. Hasil tersebut dicapai selama periode Agustus 2020 hingga Januari 2022. **Hasil:** Pemeriksaan sampel feses menunjukkan bahwa prevalensi keseluruhan infeksi parasit gastrointestinal pada kambing adalah 71,61%. Analisis data yang dilakukan selama penelitian menunjukkan bahwa tidak ada hubungan yang signifikan ($p > 0,05$) antara kabupaten kambing dan infeksi parasit gastrointestinal (GI). Persentase yang sesuai dari parasit gastrointestinal pada pria dan wanita masing-masing adalah 70% dan 72%. Namun, variabel-variabel ini tidak terkait secara signifikan (p -value = 0,399). Setelah kategorisasi, usia tidak secara signifikan terkait dengan status infeksi parasit hewan. Infeksi parasit umum yang lazim adalah jenis Nematoda, Trematoda, Cestode dan Protozoa ditemukan dalam jumlah yang berbeda. Menurut teknik flotasi dan sedimentasi, ditemukan *Eimeria sp.* (29%) (29%) dengan prevalensi yang lebih tinggi diikuti oleh *Haemonchus sp.* (23%), *Trichostrongylus sp.* (11%), *Moniezia sp.* (10%), *Trichuris sp.* (9%), *Strongyloides sp.* (7%), *Dictyocaulus sp.* (5,2%), *Nematodirus sp.* (4%), dan least adalah *Fasciola sp.* (1,0%). **Kesimpulan:** Studi ini memberikan dokumentasi komprehensif tentang beberapa parasit Gastrointestinal pada kambing di distrik Afgooye, wilayah Shabelle Bawah Negara Bagian Barat Daya, Somalia.

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INTRODUCTION

Gastrointestinal (GI) parasitism is one of the most common diseases in goats, particularly nematode infections, one of the most severe health issues that limit their productivity (Dimander et al., 2000; Charlier et al., 2009). Trematode (flake) and Cestode (tapeworm) parasites may also contribute to harmful worm burdens, especially in small animals, owing to their deleterious effects on the body of the host animals. Protozoal diseases such as Amoebiasis, Giardiasis, and Coccidiosis have also been reported in various countries (Rahmann and Seip, 2006).

GI parasitic infections are common in goats, resulting in significant economic losses due to mortality and reduced body weight gain in infected animals. Helminths and coccidia are the most common GI parasites in goats (Ozung et al., 2011). Coccidiosis in small ruminants is caused by a protozoan parasite belonging to the genus *Eimeria* and can often be seen in the small and large intestines (Chartier and Paraud, 2012). This leads to poor growth rates, diarrhea, dysentery, and anemia. It is one of the most economically significant diseases of small ruminants (sheep and goats) with regard to intensive farming is concerned (Chhabra and Pandey, 1992). It is usually suspected that when animals are kept in unsanitary conditions, mortality is most noticeable during the weaning period (Chartier and Paraud, 2012).

Host and environmental risk factors are essential for the onset of parasitic GI tract infections. Agroecological conditions, weather, and animal husbandry practices are critical environmental factors that influence the type, incidence, and severity (Badran et al., 2012, Ratanapob et al., 2012). The development of GI parasitic infections is influenced by host factors such as sex, age, body condition, and physiological status (Badaso and Addis, 2015) and parasitic factors such as worm species and population intensity (Tariq et al., 2010). According to (Nwosu et al., 2007), parasites that predispose animals to infection include localized contamination of watering areas, warm temperatures, poor management practices, and insufficient health control measures (Akhtar et al., 2000).

The prevalence of GI helminths is linked to agro-climatic factors, such as pasture quantity and quality, temperature, humidity, and grazing behavior of the host (Qayyum, 1993). GI parasites are a worldwide problem, and numerous studies have indicated their presence in various countries. Singh and Juyal, (2014) found that 907 (94.48 %) of 960 goats tested positive for one or more GI parasites including Coccidian (82.4%), *Strongyle sp.* (69.22%), *Amphistomes sp.* (22.71%), *Strongyloides sp.* (9.17%), *Trichuris sp.* (3.85%), *Moniezia sp.* (3.02%), *Schistosoma sp.* (2.29 %), and *Fasciola sp.* (1.77%). Furthermore, according to a study conducted in Nigeria, GI parasites were found in 303 of 400 goats (Sokoto and West African dwarf breeds) examined for the presence of the disease. The Red Sokoto breed has a higher prevalence of 217 (54.25%) than the West African dwarf breed, which had 21.5% (Olanike et al., 2015).

Gastrointestinal tract infections are a global problem that affect both small- and large-scale farmers. Infection by GI parasites in ruminants can cause severe economic losses in various ways, including decreased reproductive efficiency, reduced work capacity, involuntary culling, reduced food intake, poor animal growth rates, lower weight gains, treatment and management costs, and mortality in heavily parasitized animals (Ashram et al., 2017). Despite dosing, goat farmers still experience high kid mortality linked to GI parasites, endangering the long-term viability of the goat industry. Goats of all ages are affected by GI parasites, a condition that is assumed to have been worsened by community grazing, low household income levels that prevent access to anthelmintics, and the emergence of treatment resistance (Moiloa, 2017). Therefore, this study aims to close gaps in knowledge regarding GI parasitic infections in the Afgooye district of the Lower Shabelle region of Somalia.

MATERIAL and METHODS

Study Design

A cross-sectional study was conducted from August 2020 to January, 2022 to assess the prevalence and potential risk factors of GI parasites in goats; before taking the samples, the sex, age and body condition were assessed and recorded periodically. The expected prevalence of GI parasites in goats in the study area was assumed as 50% and the sample size was determined using the formula described by (Thrusfield, 1995). The study population comprised 384 goats living in seven villages in the Afgooye District of the Lower Shabelle Region, which was used as the target population for this study. Goats of all ages and sexes were included in this study.

Study Area

The study was conducted in the Lower Shabelle Region, particularly in the villages of Afgooye District. Afgooye is a town in southwestern Somalia, Lower Shebelle (Shabellaha Hoose) region. Afgooye is one of the oldest towns in the lower Shebelle Valley 30 km north of Mogadishu. Like the rest of Somalia, the climate in Lower Shabelle is hot and dry all year. The average temperature difference between the hottest months (December to March) and the most incredible months (July and August) was only a few degrees. However, it was more significant in inland areas than along the coast. In August, the temperature can decrease to 16 °C (Luling, 2002). The average maximum monthly temperature was 35 °C. The villages sampled include If iyoakhiro, Damaleey, Xaawa-taako, Buulalow, Carbiska, Xaawa-cabdi, and Lafoole. These villages were selected because of their high population of goats.

Collection of Fecal Samples

Fecal samples were collected directly from the rectum of goats using protective disposable gloves with suitable lubricants and placed in a container box. All fecal samples were collected in separate container boxes and labeled appropriately. Separate gloves were used to prevent potential cross-contamination between fecal samples. The collected

fecal samples were kept on ice and then procured to the National Laboratory of Veterinary and Animal Science, Somali, where parasitological techniques were used for the primary screening of GI infections. Fecal samples collected from the field were placed in a refrigerator at 4°C before examination for a maximum of 20 h. After collection, the samples were immediately transported to the laboratory and examined using direct fecal smear, flotation, and sedimentation methods to detect ova or larvae of the parasite.

Analysis Data

Raw data from selected areas and laboratory examinations were inserted into a Microsoft Excel spreadsheet to create a database. The collected data were analyzed using SPSS version 22.0. Descriptive statistics were used to determine the prevalence of the parasites and the risk factors associated with the disease (age, sex, body condition, and health status) and were statistically analyzed using simple statistical methods such as percentage and chi-square tests.

RESULTS

The Overall Prevalence of Gastrointestinal Parasites

Three hundred eighty-four fecal samples from goats were processed and examined for GI parasites; 275 (71.61%) were observed to harbour one or more types of GI parasites at varying levels (Table 1).

Table 1.
The Overall Prevalence of Gastrointestinal Parasites

Total Samples Examined	No. of Positive	No. of Negative	Prevalence (%)
384	275	109	71.61%

Prevalence of GI Tract Parasite in The Concerning Villages

Data analysis conducted during the study indicated that there was no significant association ($p > 0.05$) between goat villages and GI parasite infection. However, there was a minor difference between the prevalence of GI parasites in the different villages of Afgooye owing to the variation in sample sizes collected during the study (Table 2 and Figure 1).

Table 2.
Prevalence of GI Tract Parasites in Association with Villages

Villages	Number of examined animals	Number of positive animals	Prevalence (%)	Chi2	p-value
If iyoakhiro	98	73	74.5%		
Damaley	71	54	76.1%		
Xaawa-taako	69	53	76.8%		
Buulalow	54	37	68.518%	7.758	0.256
Carbiska	50	32	64.00%		
Hawa cabdi	22	15	68.18%		
Lafoole	20	11	55.00%		
Total	384	275			

Prevalence of Individual GI Parasites

Several forms of parasite ova were detected during laboratory investigations of the parasite composition. Different numbers of Nematodes, Trematodes, Cestodes, and Protozoa were

found. According to the flotation and sedimentation techniques, *Eimeria sp.* (29%) was found with a higher prevalence, followed by *Haemonchus sp.* (23%) and at least *Fasciola sp.* (1.0%) (Table 3; Figure 02).

Table 3.
Prevalence of Individual GI Parasites

Names of parasite	No. Examined	No. Positive	Prevalence %
Nematode			
<i>Haemonchus sp.</i>	384	90	23.4%
<i>Trichostrongylus sp.</i>	384	41	11.0%
<i>Trichuris sp.</i>	384	35	9.1%
<i>Strongyloides sp.</i>	384	27	7.0%
<i>Dictyocaulus sp.</i>	384	20	5.2%
<i>Nematodirus sp.</i>	384	15	4.0%
Trematode			
<i>Fasciola sp.</i>	384	4	1.0%
Cestode			
<i>Moniezia sp.</i>	384	39	10.1%
Protozoa			
Coccidian	384	110	29.0%

Associated Risk Factors of Parasite Infection

To analyze the risk variables and their relationship with the incidence of helminth parasites in goats, researchers examined sex, age, body condition score, and type of grazing used at the time of sample collection. A chi-squared test was performed to identify the association between different variables and GI parasites in goats. The corresponding percentages of GI parasites in males and females were 70% and 72%, respectively. However, these variables were not significantly associated ($p = 0.399$) (table 4).

GI parasite prevalence was slightly higher in animals with poor and moderate body conditions than in those with good body conditions, but there was no significant difference ($p > 0.05$) (Table 4). After categorization, age was not significantly associated with parasitic infection status of the animal, which is concordant with the analysis shown in table 4. We also conducted chi-square tests to assess the association of different grazing types with the parasitic infection status of the animals. The Free-grazing was slightly higher and was at 75%), followed by mixed grazing at 69%), and at least zero grazing at 60%). However, these variables were not significantly associated ($p = 0.125$) (Table 4).

DISCUSSION

The findings of the present study revealed that the overall occurrence of gastrointestinal parasitic infections in goats in the villages of Afgooye was 71.6% (275/384). The results of this study corroborate with those previous studies done [Abdi-Soojeede \(2018\)](#) that showed a high prevalence of parasitic infections in goats with a percentage of 72.1%). The current finding was slightly lower than that previous studies conducted in different areas of Ethiopia, such as 78.2% in Alage ([Moje et al., 2021](#)), 76.3% in Central Ethiopia ([Moti, 2008](#)), and 82% in Genchi District ([Emiru et al., 2013](#)). The current finding, however, was significantly lower than those of 86.7% ([Mideksa et al., 2016](#)) and 85.22% ([Pathak and Pal, 2008](#)) from Ethiopia and India, respectively. The high occur-

Table 4.
Prevalence of GI Tract Parasites Concerning Risk Factors

Risk factors	No. Examined	No. Positive	Prevalence (%)	Chi2	p-value
Sex					
Male	104	73	70%	0.14	0.399
Female	280	202	72%		
Age (years)					
≤ 1	114	79	69.3%	0.697	0.706
1-4	217	156	72%		
≥4	53	40	75.5%		
Body Condition Score					
Poor	140	99	70%	0.741	0.690
Middle	188	138	73.4%		
Good	56	38	67%		
Grazing type					
Free grazing	234	175	75%	4.157	0.125
Mixed grazing	110	76	69%		
Zero grazing	40	24	60%		

rence of parasitic infections in goats may be attributed to poor management practices at the farm, lack of anthelmintic treatment, and lack of veterinary care (Koinari et al., 2013, Sugun et al., 2015).

The most common nematode was *Haemonchus sp.* (23%). Furthermore, *Haemonchus sp.* is also the most dangerous nematode, according to earlier epidemiological studies of gastrointestinal helminths (Tsetetsi and Mbat, 2003; Bakunzi et al., 2013; Ntonifor et al., 2013). According to Roeber et al., (2013), mature females can generate thousands of eggs per day, which can quickly contaminate pastures with larvae and create outbreaks of Hemonchosis, accounting for the high incidence of *Haemonchus sp.*. The parasite's high biotic potential and pathogenicity, which make it more problematic in the wet tropics and subtropics, also play a part in the climate (Waller and Chandrawathani, 2005). *Trichostrongylus sp.*, *Oesophagostomum sp.*, *Trichuris sp.*, and *Strongyloides sp.* have also been noted in other studies (Tsetetsi and Mbat, 2003; Ayaz et al., 2013; Tsetetsi et al., 2013), in addition to *Haemonchus sp.*

In the study region, only one Cestode, *Moniezia sp.* (10.1%), was found. The findings of this study support those of earlier research by (Hurisa et al., 2021), who revealed that *Moniezia sp.* was the sole Cestode found in goats, with a percentage of 47.4%. The consumption of oribatid mites contaminated with *Moniezia sp.*, blastocysts is linked to the presence of this parasite in tropical regions (Diop et al., 2015).

The findings showed that *Eimeria sp.* was the predominant parasite found in goats at the farm and that it was *Eimeria sp.* (29%). The findings from this study were similar to previous studies conducted by (Hashim and Mat Yusof, 2016) and (Velusamy et al., 2015) in Terengganu, Malaysia, which found a higher prevalence rate of *Eimeria* infection than helminth infection in *Eimeria sp.* (89.2%). The higher rate of *Eimeria sp.* infection in goats might be due to the particular characteristics of the *Eimeria* oocyst that can survive in extreme

environmental conditions compared to helminth eggs, as proposed by (Hisamuddin et al., 2016). According to (Sharma and Mandal, 2013), this may be associated with household landholdings, which directly determine the level of livestock management such as sanitation, better living space, and nutrition. In the current study, management in the smallholder system was characterized by overcrowding in small kraals/housing, poor nutrition, frequent exposure to contaminated communal grazing, and nonexistent health control measures, as reported by Lone et al., (2012).

In our study, male and female animals were equally susceptible to infection by GI helminth parasites. The absence of a statistical association between sex and the prevalence of GI tract parasites is in agreement with that of (Temesgen and Walanso, 2015) which was conducted in Ambo town, Central Oromia, Ethiopia, and showed that the prevalence of helminth parasites was 50.0% and 48.3% in male and female animals, respectively. This also agrees with us of (Keyyu et al., 2003) and (Regassa et al., 2006) that there is no association between sex and the prevalence of GI tract parasites. Nevertheless, this is in disagreement with other reports, including (Maqsood et al., 1996) and (Urquhart et al., 1996), who were found higher infections in female animals than males, with a significant difference between them males (25.8%) and in females was (31.90%). It is assumed that sex is a determinant factor influencing the prevalence of parasitism (Maqsood et al., 1996), and females are more prone to parasitism during pregnancy and the per-parturient period because of stress and decreased immune status (Urquhart et al., 1996). In addition, (Dagnachew et al., 2011) reported a higher prevalence of helminth infections in female animals. In the present study, goats recruited from different locations were infected with GI tract parasites, although no statistically significant association ($p > 0.05$) was observed between the prevalence and location. Previous research has shown that different climatic conditions in different locations are essential factors in the development, multiplication, and survival of nematode parasites, which could translate into differences in the risk of acquiring parasites between animals managed in different locations (Woldemariam et al., 2005).

Similarly, in this study, older animals (>4 years) had a slightly higher prevalence of GI tract parasites than young animals (≤ 1 year) and adults (1-4 years). However, this difference was not statistically significant ($p > 0.05$) (Table 4). The higher prevalence of GI tract parasite infections in older animals agrees with (Temesgen and Walanso, 2015) with the result of young (40.5%), adults (48.4%), and older one (75.0%). This study observed a significant difference in the prevalence of helminth infections in terms of body condition scores. A higher prevalence was recorded in poor and middle body conditioned animals compared to good animals, at 70%, 73.4%, and 67%, respectively. This finding agrees with (Negasi et al., 2012), who showed the prevalence of parasitic infection in goats concerning body condition score and concluded with 35.63%, 60.71%, and 97.77% for good, medium, and poor, respectively. Shankute et al., (2013) also support our findings with their conclusion that good 77%, medium 84%, and poor

94%. In addition, (Radostits et al., 2006) and (Odoi et al., 2007) indicated that animals in poor conditions are highly susceptible to infection and may be clinically affected by worm burdens that are too small to harm otherwise well-fed, healthy animals. Moreover, Knox (2000) observed that a well-fed animal was not in trouble with worms, and a poor diet usually resulted in more helminth infections.

CONCLUSION

In the present study, the overall prevalence of gastrointestinal parasites in goats was 71.61%. The main gastrointestinal parasite eggs identified were *Haemonchus sp.*, *Trichostrongylus sp.*, *Trichuris sp.*, *Strongyloides sp.*, *Dictyocaulus sp.*, *Nematodirus sp.*, *Fasciola sp.*, *Moniezia sp.*, and oocysts of *Eimeria sp.*. *Haemonchus sp.* and *Eimeria sp.* are the most prevalent gastrointestinal parasites affecting goats in the Afgooye district. Goats are infected with various gastrointestinal parasites that can seriously affect the health and productivity of animals without showing any clinical signs.

These parasites affect all age and sex groups. Moreover, age, body condition, and seasonal changes were the most significant risk factors for gastrointestinal parasite infection. Besides, the weak status of animal health services, lack of proper management and public awareness, higher host range, and inadequate nutritional supplementation throughout the year. The extensive type of production system mainly used with mixed-crop livestock agriculture systems also influences the parasite burden in the environment as well as host susceptibility.

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CONFLICT of INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

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ETHICAL APPROVAL

The researchers considered ethical issues throughout the research project and kept the privacy and confidentiality of the respondents from the public. This study was approved by the Somalia National University Ethics Committee (1.03.2022-SNU /11/44) approved this study.

AUTHORS' CONTRIBUTIONS

MOSHM contributed substantially to the conception, design, analysis, interpretation of results, and discussion and drafting of this article. AMI contributed substantially to the design, supervised data collection, interpretation of results, and drafting of this article. YHSX, HAA, and MAY contributed substantially to the design, data collection, and interpretation

of the results presented in this article. KNB contributed to the analysis and interpretation of results. JBM, OMS, and ZMA contributed to data collection and interpretation of the results. All authors, MOSHM, HAA, MAY, JBM, OHA, OMS, and ZMA, participated in the revision of the manuscript and input to various drafts. All the authors have read and approved the final version of the manuscript.

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