

Abomasal nematode parasites in goats slaughtered in Mekelle town, northern Ethiopia

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Abstract

Infection with abomasal nematodes, especially haemonchosis, is one of the most important problems challenging small ruminant production in the tropics. This study was carried out to identify nematodes infecting the abomasa, and estimate their prevalence and count in goats slaughtered in Mekelle town, northern Ethiopia. A total of 166 abomasa of goats were examined for post-mortem differential adult nematode parasites count using standard procedure. *Haemonchus* spp. and *Trichostrongylus axei* were recovered from 126 (75.9%) and 109 (65.7%) abomasa, respectively. It was noted that 152 (91.6%) goats harbored at least one of the parasites, while 83 (50%) goats were found infected with both parasites. Mean and maximum adult worm counts were 39.2 and 270 and 55.2 and 600 for *Haemonchus* spp. and *T. axei*, respectively. Months of the year had significant ($p < 0.05$) effect on prevalence and adult worm count in both species of parasites identified. The adult worm count and prevalence were relatively high in February for *Haemonchus* spp. and in December for *T. axei*. The high prevalence of these economically important parasites in goats in the dry season may entail insidious losses they could incur in the productivity of goats in the study area.

Keywords: Abomasal nematodes; Ethiopia; Goat; *Haemonchus*; *Trichostrongylus axei*

Introduction

Goats in Ethiopia, with estimated population of about 30.2 million (CSA, 2017), makeup a significant proportion of the country's ruminant livestock inventory. They are integral part of the mixed crop-livestock system commonly practiced in the highlands of the country and the pastoral and agro-pastoral systems of the arid and semi-arid lowlands (Tolera and Abebe, 2007; Legesse *et al.*, 2010; Kebede *et al.*, 2012). Goats considerably contribute to household income and

nutrition of rural population of Ethiopia, and export earnings of the country (FAO, 2004; Tolera and Abebe, 2007; Legesse *et al.*, 2010).

Infections with gastrointestinal (GI) nematodes remain one of the most prevalent parasitic diseases affecting small ruminants worldwide (Torres-Acosta and Hoste, 2008). They cause considerable economic loss mainly due to insidious production loss in addition to clinical diseases and mortalities they cause (Over *et al.*, 1992). GI nematode parasites, especially haemonchosis, are significant causes of loss of productivity and mortality in small ruminants in Africa (Allonby and Urquhart, 1975; Githigia *et al.*, 2001). Though not substantially supported by studies quantifying losses, researchers have agreed that nematode infections are among the most devastating diseases of small ruminants in Ethiopia with huge economic significance (Asmare *et al.*, 2016).

Surveys conducted in different places in Ethiopia (Abebe and Esayas, 2001; Woldemariam, 2005; Menkir *et al.*, 2007; Aga *et al.*, 2013; Haile *et al.*, 2018) and elsewhere in Africa (Githigia *et al.*, 2001) demonstrated that *Haemonchus* spp., are generally the most dominant GI nematode parasites in goats. Other commonly reported groups of abomasal parasites in goats in Ethiopia include: *Trichostrongylus axei* and *Ostertagia/Teladorsagia* spp. (Abebe and Esayas, 2001; Kumsa and Wossene, 2006; Bitew *et al.*, 2011; Aga *et al.*, 2013; Teshale and Aragaw, 2014).

The development of cost-effective and sustainable control program to helminth infections requires thorough knowledge of the species of parasites present in an area among others (Hansen and Perry, 1994). Therefore, this study was conducted to identify nematodes infecting the abomasa, and estimate their prevalence and intensity of infection in goats slaughtered in Mekelle town in northern Ethiopia.

Materials and Methods

Study area

The study was conducted in Mekelle town, the capital of Tigray Region, located about 783 km north of Addis Ababa. The area lies between 13°32' and 13°30'N latitude and 39°29' and 39°39' E longitude and covers a total area of 3500 hectares in the northern highlands of Ethiopia (Fig. 1). The elevation of the city measures between 2000 and 2270 m.a.s.l. Agro-climate of the area is semi-arid

with average minimum and maximum temperature of 17.6 and 24.3°C, respectively and annual rainfall of 700 mm (TBOANR, 1999; MCPPP, 2007).

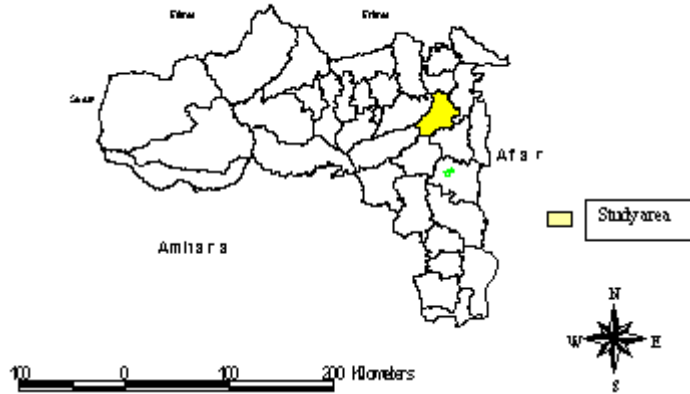


Figure 1. Location of the study in Tigray Regional State, Ethiopia

Study Animals

Abomasa of 166 local goats slaughtered in different restaurants of Mekelle town were collected for parasitological examination between November 2008 and February 2009. Goats in the area are raised with the traditional extensive system. Goats are supplied to Mekelle market from districts surrounding the town. Goats of both sexes usually aged between 1 and 4 years are slaughtered in the town.

Study design, Sampling and Sample size

The study was a cross-sectional study involving post-mortem examination of abomasa from slaughtered goats selected using a systematic random sampling technique. The sample size was determined based on 88% estimated prevalence (Kumsa and Wossene, 2006), 95% level of confidence, and 5% absolute precision (Thrusfield, 2005), requiring a minimum sample size of 162 animals. Restaurants slaughtering goats in Mekelle town were identified and those which were willing to cooperate after being briefed about the objectives of the study were included in the study.

Sample collection, processing, worm identification and count

Abomasal samples were collected from the restaurants on prearranged visits. The abomasa, after being ligated, were cut at both ends (at omasal and duodenal junctions) to separate from the rest of the digestive tract. They were transported to Mekelle Regional Veterinary Laboratory, Parasitology Department, where the laboratory examination was conducted. Standard procedures were used to recover, identify and count adult worms (MAFF, 1977; Hansen and Perry, 1994). Briefly, the abomasum was opened along the greater curvature, the contents poured into a graduated bucket, and the mucosal surface washed carefully into the bucket paying attention to the folds. The total volume was made to 2 liters from which an aliquot of 200 ml was transferred to graduated beaker while the content was stirred. The aliquot was filtered through a sieve of 250 μm apertures and the whole matter remaining on the sieve was re suspended in water. This was repeated until debris that would obscure the detection of the worms were reasonably cleared. Subsamples were placed in petridish and examined under a stereomicroscope. The numbers of worms obtained in the 200 ml aliquot were multiplied by 10 to determine the total number of worms.

Degree of infection for specific parasite species was categorized as described by Hansen and Perry (1994) as light, moderate and heavy with count of 1-500, 501-1,500, >1,500 and 1-1,000, 1,001-10,000, >10,000 for *Haemonchus* and *T. axei*, respectively.

Data analysis

Microsoft Excel was used to store the data and in the analysis of descriptive statistics. Prevalence was calculated as a percentage of goats having at least 1 worm of a certain species of parasite out of a total of goats examined. Comparison of prevalence among months was analyzed using Chi-square test. The worm count data were log transformed [$\log_{10}(\text{EPG} + 1)$] and worm count difference between months was analyzed using one-way analysis of variance (ANOVA). STATA version 7 was used for the Chi-square and SPSS version 13 for the ANOVA.

Results

Prevalence

Two species of nematode parasites, namely *Haemonchus* spp. and *Trichostrongylus axei* were identified from the abomasa of the study goats. Out of the 166 abomasa of goats examined 126 (75.9%, 95% CI: 69.3-82.5) and 109 (65.7%, 95% CI: 58.4-73.0) were harboring *Haemonchus* spp. and *T. axei*, respectively. The overall prevalence of abomasal parasites was 91.6% (95% CI: 87.3-95.8). Eighty-three (50%, 95% CI: 35.0-65.0) of the goats had both parasites in their abomasa (Table 1).

Table 1. Prevalence of abomasal parasites in goats slaughtered in Mekelle town, northern Ethiopia (n=166)

Parasite species	No. positive	%Prevalence	95 % CI
<i>Haemonchus</i> spp.	126	75.9	69.3 - 82.5
<i>T. axei</i>	109	65.7	58.4 - 73.0
<i>Haemonchus</i> spp. and <i>T. axei</i>	83	50.0	35.0- 65.0
At least one parasite	152	91.6	87.3 - 95.8

Month had significant ($P<0.05$) effect on prevalence of both species of parasites identified (Table 2). The highest proportion of goats with at least one adult parasite was recorded in February for *Haemonchus* spp. (100%) and in December for *T. axei* (81%).

Worm burden

Mean adult parasitic worm count from abomasa of goats slaughtered in Mekelle during the study period is shown in Table 2. The recorded mean counts (considering all goats examined) were 39.5 and 55.2 for *Haemonchus* spp. and *T. axei*, respectively. The corresponding mean (\pm SE) adult worm count for positive goats were 52.1 (\pm 4.4) and 84.0 (\pm 9.8).

Significant differences ($P<0.05$) were observed among months in mean worm count for both *Haemonchus* spp. and *T. axei* (Table 2). Relatively highest counts were observed in February for *Haemonchus* spp. and in December for *T. axei*.

The maximum counts recorded were 270 and 600 in December for *Haemonchus* spp. and *T. axei*, respectively. *Haemonchus* spp. has shown relative highest prevalence and mean count in February.

Counts for both parasites in all positive goats observed in the study (maximum count of 270 and 600 adult worms for *Haemonchus* and *T. axei*, respectively) revealed light degree of infection.

Table 2. Monthly prevalence and worm burden of abomasal nematodes in goats slaughtered in Mekelle

Parasite species	Month	No. Examined	Prevalence				Worm burden		
			No. (%) Positive	95 % CI	χ^2	P value	Mean (\pm SE)	Min	Max
<i>Haemonchus</i> spp.	Nov	24	19(79.2)	62.9 – 95.4	11.8	0.008	30.8 (\pm 6.4)a	0	120
	Dec	79	52(65.8)	55.4 – 76.3			29.6 (\pm 5.3)a	0	270
	Jan	42	34(81.0)	69.1 – 92.8			37.6 (\pm 5.2)a	0	130
	Feb	21	21(100)	-			90.5 (\pm 13.5)b	20	220
	Overall	166	126(75.9)	69.3-82.5			39.5 (\pm 3.8)	0	270
<i>T. axei</i>	Nov	24	5(20.8)	4.6 – 37.1	33.3	0.000	9.6 (\pm 4.4)a	0	80
	Dec	79	64(81.0)	72.4 – 89.7			86.7 (\pm 13.6)b	0	600
	Jan	42	30(71.4)	57.8 – 85.1			39.5 (\pm 6.3)b,c	0	140
	Feb	21	10(47.6)	26.3 – 69.0			26.8 (\pm 5.9)a,c	0	80
	Overall	166	109(65.7)	58.4-73.0			55.2 (\pm 7.1)	0	600

a,b,cMeans followed by different superscripts differ significantly (P<0.05)

Discussion

Only two genera of nematodes namely *Haemonchus* and *Trichostrongylus* were detected in the abomasa of the study goats. This is in agreement with the reports of similar studies in the northern and eastern parts of the country (Abebe and Esayas, 2001; Kumsa and Wossene, 2006; Menkir *et al.*, 2007; Teshale and

Aragaw, 2014). However, studies in southern Ethiopia (Asha and Wossene, 2007; Thomas *et al.*, 2007; Bitew *et al.*, 2011; Demissie *et al.*, 2013) frequently documented the occurrence of another abomasal nematode parasite namely *Teladorsagia (Ostertagia)* spp. in addition to the two genera recovered in this study. *Ostertagia* is known to be especially important in temperate climates and in subtropical regions with winter rainfall (Urquhart *et al.*, 1996).

The high overall prevalence (91.6%) of abomasal nematodes in goats in Mekelle, revealed by the current study is comparable to 95% (Abebe and Esayas, 2001) and 90.2% (Kumsa and Wossene, 2006) prevalence reported from eastern and 87.1% from southern Ethiopia (Thomas *et al.*, 2007). It was, however, higher compared to 45.2% (Teshale and Aragaw, 2014) and 61.8% (Bitew *et al.*, 2011) prevalence reported from northwestern and southern Ethiopia, respectively. Such high prevalence of abomasal helminth parasites in goats suggests existence of favorable environmental conditions for survival and development of nematode larvae to infective stage in the study area. It also suggests that goats, which are normally browsers, may have been forced to graze perhaps due to lack of adequate browsing material in the study area (Le Jambre and Royal, 1976).

The recorded high prevalence of *Haemonchus* spp. (75.9%) in our study was in agreement with 76.5% (Thomas *et al.*, 2007) and 75.2% (Demissie *et al.*, 2013) prevalence reported from southern Ethiopia. Bitew *et al.* (2011) from southern Ethiopia (55.9%) and Teshale and Aragaw (2014) from northwestern Ethiopia (43.5%) have reported much lower prevalence. Other works however recorded higher prevalence of the parasite in slaughtered goats in Ethiopia (Abebe and Esayas, 2001; Kumsa and Wossene, 2006).

Comparable prevalence of *T. axei* (64.3%), to our study (65.7%), was recorded in eastern Ethiopia by Abebe and Esayas (2001). However, several other studies from different parts of the country recorded lower prevalence of the parasite in slaughtered goats (Kumsa and Wossene, 2006; Thomas *et al.*, 2007; Bitew *et al.*, 2011; Demissie *et al.*, 2013; Teshale and Aragaw, 2014). These differences in prevalence of the parasites among the studies are most likely due to difference in environmental conditions, as they affect the development and survival of the parasites outside and inside the host (Urquhart *et al.*, 1996).

The average worm count observed for both *Haemonchus* spp. (39.5) and *Trichostrongylus axei* (55.2) in our study were much lower compared to reports of sev-

eral similar earlier studies in Ethiopia (Abebe and Esayas, 2001; Menkir *et al.*, 2007; Thomas *et al.*, 2007; Teshale and Aragaw, 2014). This may be explained by difference in agroclimatic conditions among the study areas which affect favorability of the environment for development and survival of the free living stages of the parasites (Urquhart *et al.*, 1996). It may also be partly explained by difference in season of study among the reports. Our study was conducted during the dry season where parasite prevalence and burden are usually low (Bekele *et al.*, 1987; Tembely *et al.*, 1997; Menkir *et al.*, 2007).

In the present study all of the goats harboring adult abomasal parasites were affected by light degree of infection based on the interpretation suggested by Hansen and Perry (1990). In a somewhat different result Kumsa and Wossene (2006) in goats from eastern Ethiopia found a few animals with heavy infection, while majority of the infected goats were with light to moderate degree of infection. The reasons for light degree of infection for both parasites notwithstanding high prevalence need further investigation.

Monthly prevalence and total adult worm burden of the identified abomasal parasites in the study period had shown difference which was relatively highest in February for *Haemonchus* spp. and in December for *T. axei*, although there was no change in degree of infection. This difference is difficult to explain as there was no significant rain during the study period in the area. Under Ethiopian highland conditions, moisture appears to have the most important effect on the development and survival of eggs and larvae of nematodes (Haile *et al.*, 2010).

Conclusions

The present study demonstrated high prevalence of pathologically the most important nematode parasite of ruminants- *Haemonchus* spp.- along with *T. axei* in goats in the study area, albeit with light degree of infection. The results suggest insidious losses of production in goats in the study area due to helminth parasites.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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