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Abomasal nematodes of small ruminants slaughtered in Bahir Dar Town, North West Ethiopia

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This study was conducted during November, 2013 to March, 2014 to identify the species and to determine the burden of abomasal nematodes of small ruminants slaughtered in Bahir Dar town. A total of 384 abomasa (269 sheep and 115 goats) were collected and examined according to the standard procedures. An overall prevalence of 55.7% was recorded for abomasal nematodes of sheep and goats. The host specific prevalence of abomasal nematodes was 60.2 and 45.2% in sheep and goats, respectively. Two nematodes, *Haemonchus* spp. and *Trichostrongylus axei* were identified both in sheep and goats. The prevalence of *Haemonchus* and *T. axei* was 53.5 and 48.7% in sheep and 43.5 and 26.1% in goats, respectively. Mean worm counts of *Haemonchus* spp. and *T. axei* were 413.5 and 225.3 in sheep and 316.5 and 71.3 in goats, respectively. Sheep had higher (P < 0.01) prevalence (48.7%) and worm burden (225.3) of *T. axei* compared to goats (45.2 and 71.3%). Both sheep and goats with lean body condition had higher (P < 0.001) prevalence and worm count for both *Haemonchus* spp. and *T. axei* compared to their counter parts with good body condition. The great majority of the infected sheep and goats were with light to medium degree of infection. This study adds information to the epidemiology of abomasal nematodes in Ethiopia and may be used in the design of control strategies.

Key words: Abomasum, goat, *Haemochus*, sheep, *Trichostrongylus axei*

INTRODUCTION

In Ethiopia, small ruminants play important roles in all agricultural production systems. They thrive and produce in all agro-ecological zones; from semi-arid to arid lowlands to the Afro-Alpine (*Guassa*) ecosystem. Although Ethiopia is endowed with the highest population of small ruminants in Africa, with 24.2 million sheep and 22.6 million goats (CSA), 2012), the benefit the country is obtaining from the resource is way below expected due to multitude of factors. Diseases are among the constraints affecting the productivity of small ruminants in Ethiopia (Njau et al., 1988; Bekele et al., 1992; Zewde and Lidetu, 2008; Petros et al., 2014). Diseases cause mortality; reduce growth, milk production, reproductive perfor-mance and product and by-product quality and interfere

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interfere with international trade of livestock and livestock products. Among diseases, helminthoses are perhaps the most prevalent and cause huge economic losses due to mortality and morbidity (Njau et al., 1988; Bekele et al., 1992; Kaur et al., 2008; Kaur et al., 2013) in addition to the most important insidious losses associated to them (Singla, 1995).

Epidemiological information of parasites of a geographical location is important in prioritizing diseases for intervention and design of control strategies. There are reports on the prevalence, species composition and burden of abomasal parasites in sheep and goats from different parts of Ethiopia. These studies revealed the presence of *Haemonchus* spp., *Trichostrongylus axei*, and *Ostertagia/Teladorsagia circumcincta*, with overall prevalence of 61.8 to 92.9% of abomasal parasites (Kumsa and Wossene, 2006; Abunna et al., 2009; Bitew et al., 2011; Demissie et al., 2013). Yet, there is shortage of such information in some areas of the country including Northern Ethiopia. The aim of this study was, therefore, to identify the species and to determine the degree of infection of abomasal nematodes in sheep and goats slaughtered in Bahir Dar, North Western Ethiopia.

MATERIALS AND METHODS

Study area

Bahir Dar, the capital of Amhara Region, is situated on the southern shore of Lake Tana, the sources of the Blue Nile (or Abay). The city is located approximately 578 km northwest of Addis Ababa, having a latitude and longitude of 11° 36' N 37° 23' E and an elevation of 1,800 meters above sea level (http://en.wikipedia.org/wiki/Bahir_Dar).

Study animals

The study included 269 sheep and 115 goats (384 small ruminants) of both sexes slaughtered in Bahir Dar town between November, 2013 and March, 2014. Sheep and goats slaughtered at Bahir Dar usually originate from Bahir Dar zuria, Farta and Estae districts.

Study methodology

Sampling units were selected using two stage sampling. Restaurants and hotels were selected based on convenience. Study animals were selected using systematic random sampling technique. Species, sex, body condition score (BCS) and origin of animals were recorded before slaughter by interviewing the responsible individuals and observation of the animals. BCS was assessed according to Abebe and Yami (2008). For convenience, the score was categorized into two groups: lean (scores 1 and 2) and good (scores 3 and 4).

Abomasa were collected soon after evisceration usually within 30 min. The two ends at omaso-abomasal junction and pylorus were ligated to avoid leakage before separated from omasum and duodenum. The abomasa were then immediately transported to the Bahir Dar Regional Veterinary Laboratory for parasitological examination. Worm recovery, identification and counting were made according to standard procedures (MAFF, 1977; Hansen and Perry, 1994). The degree of infection by adult *Trichostrongylus* spp. and *Haemonchus* spp. was categorized as light (1 to 1000; 1 to 500), moderate (1001 to 10000; 501 to 1500) and heavy (>10000; >1500), respectively as described by Hansen and Perry (1994).

Data management and analysis

All the data collected (species, sex, BCS, origin, parasite species and count) were entered to MS Excel and analyzed using STATA version 11.0 software (Stata Corp., College Station, TX 77845, USA). Prevalence was calculated as the percentage of the animals with the parasite of interest of the total animals examined. Associations between predictor variables (species, sex, BCS) and response variable (parasite prevalence) considered in the study were assessed using logistic regression analyses. Effect of the factors on abomasal nematode count was tested using *t*-test and one way ANOVA.

RESULTS

Two nematodes namely *Haemonchus* spp*.* and *Trichostorongylus axei* were identified infecting the abomasa of the study sheep and goats. Out of a total of 384 abomasa of sheep (n = 269) and goats (n = 115) examined, 214 (55.7%) were positive for at least one of the nematodes. The prevalence of abomasal nematodes was 60.2 and 45.2% in sheep and goats, respectively. The prevalence was significantly (P < 0.01) higher in sheep than in goats. The prevalence of *Haemonchus* spp. and *T. axei* was 53.5 and 43.5%, in sheep and was 48.7 and 26.1% in goats, respectively. The prevalence of *Haemonchus* spp. just failed to be significantly different (P = 0.07) between sheep and goats. However, the prevalence of *T. axei* was significantly higher (P < 0.001) in sheep than in goats (Table 1). The effects of sex, body condition and origin of the animals on the prevalence of abomasal nematodes were assessed. Of these factors, a statistically significant association (P < 0.001) was observed only between body condition of the animals and abomasal nematode prevalence in both sheep and goats. Accordingly, lean sheep and goats had higher prevalence of *Haemonchus* spp. (71.1 and 60.3%) and *T. axei* (63.6 and 25.0%) compared to their counter parts with good body condition (21.9 and 21.9%, 19.1 and 4.3%) (Tables 2 and 3).

Mean worm counts for *Haemonchus* spp. and *T. axei* in sheep and goats were 413 and 316.5, and 225.3 and 71.3, respectively. The difference in mean count of *Haemonchus contours* between sheep and goats just failed to be statistically significant (P = 0.0652). The difference in the count of *T. axei* was, however, significantly higher in sheep than in goats (P < 0.001) (Table 4). Among the factors considered, worm burden was significantly (P <0.001) associated only with body condition of the animals. The counts of both *Haemonchus* spp. and *T. axei* were significantly higher in lean sheep

Table 1. Prevalence of abomasal nematodes in sheep and goats.

Species	n	*Haemonchus*			*T. axei*			At least one parasite		
		Positive (%)	OR	P-value	Positive (%)	OR	P-value	Positive (%)	OR	P-value
Sheep	269	144 (53.5)	1.5	0.07	131(48.7)	2.7	0.000	162 (60.2)	1.8	0.006
Goat	115	50 (43.5)	1		30 (26.1)	1		52 (45.2)	1	
Overall	384	194 (50.5)	-		161(41.9)			214 (55.7)		

Table 2. Effects of sex, body condition score (BCS) and origin of sheep on prevalence of abomasal nematodes.

Variable		n	*Haemonchus*			*T. axei*		
			No (%)	OR	P-value	No (%)	OR	P-value
Sex	Male	152	81 (53.3)	1	0.927	75 (49.3)	1	0.809
	Female	117	63 (53.8)	1.02		56 (47.9)	0.94	
BCS	Good	96	21 (21.9)	1	0.000	21 (21.9)	1	0.000
	Lean	173	123 (71.1)	8.79		110 (63.6)	6.24	
Origin	B/Dar	97	54 (55.7)	1	0.694	51 (52.6)	1	0.586
	Estae	94	47 (50.0)	0.80		45 (47.9)	0.83	
	Farta	78	43 (55.1)	0.98		35 (44.9)	0.73	

Table 3. Effects of sex, body condition score (BCS) and origin of goats on prevalence of abomasal nematodes.

Variable		n	*Haemonchus*			*T. axei*		
			No (%)	OR	P-value	No (%)	OR	P-value
Sex	Male	64	27(42.2)	1	0.754	16(25)	1	0.766
	Female	51	23(45.1)	1.13		14(27.5)	1.14	
BCS	Good	47	9(19.1)	1	0.000	2(4.3)	1	0.000
	Lean	68	41(60.3)	6.4		28(25.0)	15.75	
Origin	Bahir Dar	44	18(40.9)	1	0.89	11(25)	1	0.934
	Estae	32	14(43.8)	1.12		8(25)	1	
	Farta	39	18(46.2)	1.24		11(28.2)	1.18	

and goats compared to their contemporaries with good body condition. The mean counts of *Haemonchus* spp. in lean and good body conditioned sheep were 548.6 and 168.8, respectively, while the mean counts of *T. axei* were 298.8 and 92.7, respectively. The corresponding counts in goats for *Haemonchus* spp. and *T. axei* in lean and good body conditioned goats were 455.9 and 114.9 and 113.2 and 10.6, respectively (Tables 5 and 6). Among infected sheep and goats the majority were with light degree of infection by both *Haemonchus* spp. and *T. axei*. Accordingly, 70.1% of the infected sheep and 80.0% of the infected goats were with light degree of infection with *Haemonchus*, and 64.1 and 100% of the infected sheep and goats, respectively were with light degree of infection with *T. axei*. Moderate degree of infection was recorded in relatively small proportion of

Table 4. Mean worm count of sheep and goats.

Species	n	*Haemonchus*				*T. axei*			
		Mean	**S.E.**	**Max**	**P-value**	**Mean**	**S.E.**	**Max**	**P-value**
Sheep	269	413.0	29.4	1500	0.0652	225.3	18.9	1200	0.000
Goat	115	316.5	40.4	1400		71.3	13.1	600	

Table 5. Association of mean worm count with sex, body condition score (BCS) and origin of sheep.

Variable		n	*Haemonchus*			*T. axei*		
			Mean	**S.E.**	**P-value**	**Mean**	**S.E.**	**P-value**
Sex	M	152	414.5	39.4	0.9550	229.6	24.7	0.7944
	F	117	411.1	44.4		219.7	29.3	
BCS	Good	96	168.8	30.1	0.0000	92.7	21.8	0.0000
	Lean	173	548.6	36.5		298.8	25.1	
Origin	B/Dar	97	420.6	48.1	0.7566	230.9	30.6	0.9585
	Estae	94	433.0	53.9		218.1	31.7	
	Farta	78	379.5	50.6		226.9	36.8	

Table 6. Association of mean worm count with sex, body condition score (BCS) and origin of goats.

Factor		n	*Haemonchus*			*T. axei*		
			Mean	**S.E.**	**P-value**	**Mean**	**S.E.**	**P-value**
Sex	M	64	325.0	56.9	0.8152	65.6	16.4	0.6297
	F	51	305.9	57.1		78.4	21.4	
BCS	Good	47	114.9	39.5	0.0000	10.6	7.6	0.0001
	Lean	68	455.9	56.9		113.2	20.1	
Origin	B/Dar	44	300.0	64.6	0.9468	84.1	25.2	0.7310
	Estae	32	321.9	79.2		59.4	21.5	
	Farta	39	330.8	69.8		66.7	19.9	

of infected sheep and goats: 29.9 and 33.6% in sheep and 20.0 and 0% in goats with *Haemonchus* and *T. axei,* respectively. Heavy infection was not observed for both species of parasites in both hosts.

DISCUSSION

We identified only *Haemonchus* spp. and *T. axei* from the abomasa of the study animals. In agreement with our finding, Kumsa and Wossene (2006) and Sissay et al. (2007) reported only these two genera of nematodes in sheep and goats in Eastern Ethiopia. However, other studies reported *Teladorsagia* spp., in addition to the two genera, from central (Abunna et al., 2009; Shankute et al., 2013) and Southern Ethiopia (Asha, 2005; Bitew et al., 2011; Demissie et al., 2013). Asha (2005), in his study in Southern Ethiopia, showed that *Teladorsagia* spp. was limited in distribution to the highland areas. *Ostertagia*/*Teladorsagia* is important, especially in temperate climates and subtropical regions (Urquhart et al., 1996).

This study revealed an overall prevalence of 55.7% for abomasal nematodes in sheep and goats which is low compared to 86.7% prevalence recorded in Bishoftu in central Ethiopia (Abunna et al., 2009) but higher than

30.98% reported from Iran (Nabavi et al., 2011). The host specific prevalence of abomasal nematodes recorded in our study (60.2% for sheep and 45.2% for goats) was low, compared to reports from central (83.6 and 77.6%) (Abunna et al., 2009), southern (82 and 76.4%) (Demissie et al., 2013) and eastern part of the country (92.9 and 90.2%) (Kumsa and Wossene, 2006).

A prevalence of 53.5% and 43.5% for *Haemonchus* spp. and 48.7% and 26.1% for *T. axei* was registered in sheep and goats, respectively. The prevalence of *Haemonchus* spp. both in sheep and goats was low compared to reports from different parts of the country which ranged from 75.9 to 91.2% in sheep and from 55.9 to 82.9% in goats (Kumsa and Wossene, 2006; Abunna et al., 2009; Bitew et al., 2011; Demissie et al., 2013). The prevalence of *T. axei* in sheep (48.7%), observed in this study, is low compared to 90.4% reported from central Ethiopia (Abunna et al., 2009) while it is high compared to the 25.7% (Demissie et al., 2013) and 37.7% (Kumsa and Wossene, 2006) prevalence reported from southern and eastern part of the country, respectively. The 26.1% prevalence of *T. axei* in goats is low compared to 81.3% prevalence recorded in Central Ethiopia (Abunna et al., 2009) and 40.2% prevalence from Eastern Ethiopia (Kumsa and Wossene, 2006). However, it was higher than 9.8% reported from Hawassa in South Ethiopia (Demissie et al., 2013).

The variation in prevalence among the different studies may be due to differences in agro-ecological conditions. The fact that the present study was conducted in dry season in slaughter animals may have underestimated the prevalence of abomasal nematodes in sheep and goats in the study area as helminth prevalence is high in the wet seasons (Bekele et al., 1987; Regassa et al., 2006) and animals with better body conation usually are preferred for slaughter.

Species of the host had no significant effect (P = 0.07) on *Haemonchus* spp. prevalence. This is consistent with reports from Central Ethiopia (Abunna et al., 2009; Shankute et al., 2013). *T. axei* prevalence, however, was higher in sheep (48.7%) than in goats (26.1%). A number of previous studies in Ethiopia have reported high prevalence of helminthes in sheep than in goats (Negasi et al., 2012; Zeryehun, 2012). On the other hand, in a coprological study conducted in Central Ethiopia, Kumsa et al. (2011) could not find significant difference in prevalence of nematodes between sheep and goats. As goats generally prefer to browse than graze, they were expected to be less affected with gastrointestinal parasites than sheep.

The adult worm count of *Haemonchus* in sheep (413.0) and goats (316.5) in our study is high compared to the count recorded (275.44 and 245.31) in Central Ethiopia. However, the count of *T. axei* in our study (225.3 in sheep and 71.3 in goats) is low compared to 469.3 and 395.3 recorded in the same study (Abunna et al., 2009).

Research outputs in Ethiopia (Regassa et al., 2006; Sissay et al., 2007) and elsewhere (Lone et al., 2012) indicated the influence of geographical location on parasite prevalence and burden. Contrary to this, origin of the animals had no effect on prevalence and count of abomasal nematodes in our study.

We found body condition significantly associated (*P* < 0.001) with the prevalence and worm count of *Haemonchus* and *T. axei* both in sheep and goats. This is in agreement with Shankute et al. (2013) who recorded highest prevalence of abomasal nematodes in sheep and goats with poor body condition. Chronic haemonchosis and trichostrongylosis are associated with weight loss, poor growth rates and inappetence (Urquhart et al., 1996). Sex was not associated (P > 0.05) with both prevalence and count of the parasites. Similarly, Regassa et al. (2006) did not find association between parasitic egg prevalence and count with sex. The species of the host had no statistically significant (P = 0.0652) effect on adult *Haemonchus* count. The count of *T. axei*, however, was very high in sheep than in goats (P < 0.001). Kumsa and Wossene (2006) reported higher mean monthly worm count in sheep than in goats.

All the infections observed in the present study fall under light to moderate degree. This was in a general agreement with reports from Ethiopia (Kumsa and Wossene, 2006; Shankute et al., 2013) and elsewhere in Africa (Almalaik et al., 2008) where majority of the sheep and goats were affected with light to moderate degree of infection. Moderate infection with *Haemonchus* was reported to cause chronic anemia, severe loss of body condition and death in sheep grazing on poor quality pasture (Allonby and Urquhart, 1975).

This study added to the knowledge of the epidemiology of abomasal parasites in sheep and goats in Ethiopia in general and revealed that *Haemonchus* spp. and *T. axei* are prevalent with light to moderate degree of infection in small ruminants slaughtered in Bahir Dar. The information may be used in design and application of control strategies.

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Conflict of Interest

The author(s) have not declared any conflict of interests

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