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Prevalence of abomasal nematodes in sheep and goats slaughtered at Haramaya municipal abattoir, eastern Hararghe, Ethiopia

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Abstract
The study was conducted from November 2009 to March 2010 in Haramaya district, eastern Hararghe zone of Oromiya region, Ethiopia. The objective of the study was to determine the prevalence of abomasal nematodes of small ruminants slaughtered at Haramaya municipal abattoir. During the study period a total of 384 abomasums of small ruminants (181 sheep and 203 goats) were examined. Three genera of nematodes were identified in both sheep and goats abomasa with overall prevalence of 95.8%. The prevalence in sheep and goats were 94.5% and 97% respectively. The prevalence in both animal species was 85.7% *Haemonchus contortus*, 82.3% *Trichostrongylus axei* and 79.9% *Teladorsagia.* The specific prevalence observed were 90% for *Haemonchus contortus*, 75.7 % for *Trichostrongylus axei*, and 80.7 % for *Teladorsagia* spp. in sheep and 81.8 % for *Haemonchus* contortus, 88.2 % for *Trichostrongylus axei* and 79.3 % for *Teladorsagia* spp. in goats. Statistically significant differences ($P<0.05$) in nematode species except *Teladorsagia* species was observed. There was no statistically significant differences ($P>0.05$) among the risk factors of age and sex considered in relation to the prevalence of abomasal nematodes. Generally, a high infection rate of small ruminants with abomasal nematodes was observed during the study period.
Keywords: Small ruminants, Abomasal nematodes, Prevalence, Haramaya, Abattoir

Introduction
Ethiopia, with its great variation in climate and topography, possesses one of the largest small ruminant populations in Africa. The latest estimate of small ruminant population gives 23.6 million sheep and 23.3 million goats (CSA, 2004). Small ruminants play a significant role in maintaining household stability by providing meat, milk, skin and wool, generate cash income and play traditional social and religious roles (Devendera & Mclery, 1982; El- Azazy, 1995). Studies have revealed that ruminants contribute 80 % of the total food production from livestock in tropical Africa, of which small ruminants account for about 22 %. However, in spite of the presence of huge numbers of small ruminant populations, Ethiopia fails optimally to exploit these resources. This is due to a multitude of constraining factors like ill health (Bekele *et al.*, 1982; Teklye *et al.*, 1987). Health disorders in all classes of small ruminants represent the major problems and greatly affect the economics of sheep and goat production. Gastrointestinal helminthosis is among the main constraints to small ruminant productions in Ethiopia. These parasites pose subtle economic losses and are the major factors responsible for lowered levels of production in many parts of the country. Abomasal nematodes and liver flukes are believed to be the most prevalent and widely distributed helminthes (Barger, 1982). Even though the losses incurred by these parasites are believed to be significant, accurate and up-to-date estimates of the economic impacts are lacking in Ethiopia. Available information revealed that infection due to abomasal nematodes especially *Haemonchus contortus* is responsible for important morbidities and mortalities in sheep and goats in different parts of the country (Bekele *et al.*, 1982; Teklye *et al.*, 1987). Mulugeta *et al.* (1989) reported yearly losses amounting to USD 82 million due to endoparasites in Ethiopia. Krecek and Waller (2006) reported that *Haemonchus contortus* alone is responsible for annual loss ranging from USD 26 million to 45 million in Kenya and South Africa. Studies conducted on gastrointestinal helminthosis of small ruminants (Abebe & Esayas, 2001; Bekele *et al.*, 1982; Donald, 1999) indicated the importance of nematodes as a cause of impaired productivity. However, nationwide studies have never been carried out to determine the distribution of abomasal nematodes. Most previous studies in Ethiopia were based on coprological examinations, which are less sensitive in identifying the nematode species. We conducted this study to identify the species and determine the prevalence of abomasal nematodes of small ruminants slaughtered at Haramaya Municipality Abattoir and to assess major risk factors associated with abomasal nematodes of sheep and goats.

MATERIALS AND METHODES
Study area
Haramaya district is located in the eastern Hararghe zone of Oromiya region, Ethiopia, 14km from west of Harar and 508km east of Addis Ababa. According to Haramaya district agricultural statistics information, the district has about 63,723 cattle, 13,612 sheep, 20,350 goats, 15,978 donkeys, 530 camels and 42,035 chickens. The production system of the district is mixed type. Topographically, it is situated at altitude of 1600-2100m above

sea level with the mean annual temperature and relative humidity of 18ºc and 65% respectively. There are four seasons; these are a short rain season (from mid-March to mid-May), a short dry season (from end of May to end of June), along wet season (early July to mid-October) and a long dry season (end of October to end of February). Main pasture production is expected after the short rain season, continuing until, and the end of the long wet season (HADB, 2009). The Haramaya area receives an average annual rain fall of approximately 900mm, with a bimodal distribution pattern, picking in mid-April and mid-August. The vegetation that constitutes the available pasture lands in this area is predominantly native grasses and legumes interspersed with open Acacia shrub land. Geographically it is located 041º 59' 58" N latitude and 09º 24' 10"S longitudes. The average temperature is 9.5-24 ºc with low temperature fluctuation. Climatically the district has two ecological zones of which 66.5% is midland and 33.3% is low land (HADB, 2009).

Study animals and sample collection

The study was conducted from November 2009 through March, 2010 on small ruminants (sheep and goats) slaughtered in Haramaya Municipality abattoir by collecting their abomasums. Most of the study animals were originated from Haramaya district, Harare region and different areas of eastern Hararghe zone. The ages of slaughtered animals ranges from 1-7 years and estimated according to Oltenacu and Tatiana (1999) and Getanby (1991). The studied animals were both male and female. The abomasums were removed from omasum and duodenum immediately after opening of abdominal cavity, legated at both ends, and immediately taken out and washed to the sample container. The collected sample was transported to the laboratory of veterinary parasitology of college of veterinary medicine, Haramaya University for appropriate examination.

Abomasal worm recovery and identification

A total of 181 and 203 abomasums of sheep and goats were examined respectively according to the standard procedures described by Hanson and Perry (1994) and MAFF (1977). The abomasums were opened along its great curvature and its contents were washed thoroughly in to a graduated bucket under a slow jet of water. The mucous membrane was carefully rubbed with fingers to remove any worms adhering to it. The content and washings were made to a total volume of two litters. Then it was vigorously stirred until all the abomasal contents, mucous and water was thoroughly mixed. Aliquot of 200ml was transferred to a labeled graduated cylinder in five steps of 40ml per step while string the mixture continuously. The wash jar was filled with water and screwed securely. The jar was inverted and shaken until most of the fluid was shaken out and repeated until all the ingesta removed and water was added. The 200ml sub sample was filtered through sieve of 250µm aperture that can retain adult worms there in. Finally 5ml of sample was taken in to Petri-dish and stained with 2-3ml of iodine solution, allowed to stand for 35 minutes and examined under Stereo-microscope for presence of nematode and species identification of the nematodes was examined under compound microscope (×10) power. The identification of worm was according to (Over *et al.*, 1992).

Sample size determination

The sample size was determined by considering with no previous study in the area and by taking 50% prevalence. The sample size for the study was calculated using (Thrusfield, 1995) formula. Accordingly, a sample size of 384 small ruminants was considered for the study.

$$n = \frac{1.96^2 . Pex (1-Pex)}{d^2}$$

Where: n = required sample size, Pex = recorded previous prevalence = 50%, d = desired absolute precision =5%

Statistical analysis

Microsoft excel software were used to store all the data of abomasal nematode parasites and STATA version7.0 was used to analyze the data. Chi-square statistics were used to test association between variables and descriptive statistics to summarize the data in tables. When P value is less than 0.05 the presence of significance difference is considered.

RESULTS

The examination of 384 abomasums of sheep and goats revealed 368 positive and 16 negative animals slaughtered with the overall prevalence of 95.8% (95% CI=93.8-97.8%) of abomasal nematodes (Table 1).

Table1: Total prevalence of abomasal nematodes in examined small ruminants

Total number of animals sampled	Number of animals positive	Number of animals negative	Prevalence (%)	95% CI
384	**368**	**16**	**95.8**	**93.8 - 97.8**

Where; CI: confidence interval

Out of the total examined abomasums of sheep and goats the presence of three different species of nematodes: 85.7% of *H. contortus*, 82.3% of *T. axei* and 79.9% of *Teladorsagia* in both species of animals were observed (Table 2).

Table 2: Prevalence of each species of the parasites

Parasites identified	Total abomasums examined	Number of positive	Prevalence (%)	95% CI
Haemonchous contortus	384	329	85.7	50.7-89.2
Trichostrongylus axei	384	316	82.3	78.5-86
Teladorsagia	384	307	79.9	75.9-83.9
Total	384	368	95.8	93.8- 97.8

The total prevalence of abomasal nematode, *H. contortus*, in sheep and goats was 85.7%. The prevalence of this parasite in sheep and goats: 90.1% and 81.8% respectively and, with sex: male (83.4%) and female (88.6%). Similarly the prevalence with age groups of study animals: <2 years (84%), 2-3 years (88.5%) and >4 years (83%) as depicted in (Table 3).

Table 3: The prevalence of *H. contortus* based on species, sex and age groups

Variables		No. examined	No. positive	Prevalence %	χ^2	P-value
Species	Sheep	181	163	90.1		
	Goats	203	166	81.8	5.348	0.021
	Total	384	329	85.7		
Sex	Male	217	181	83.4		
	Female	167	148	88.6	2.0896	0.148
	Total	384	329	85.7		
Age	<2 years	75	63	84		
	2-4 years	174	154	88.5	2.1168	0.347
	>4 years	135	112	83		
	Total	384	329	85.7		

As the result shown in table 4, the total prevalence of abomasal nematode, *T. axei*, in sheep and goats was 82.3%. The prevalence of this parasite in sheep and goats: 75.7% and 88.2% respectively, with sex: male (81.6%) and female (83.2%). Similarly the prevalence with age groups of study animals: <2 years (82.7%), 2-3 years (83.3%) and >4 years (80.7%) (Table 4).

Table 4: The prevalence of *T.axei* based on species, sex and age groups

Variables		No. examined	No. positive	%positive	χ^2	P-value
Species	Sheep	181	137	75.7		
	Goats	203	179	88.2	10.237	
	Total	384	316			
Sex	Male	217	177	81.6		
	Female	167	139	83.2	0.1799	0.671
	Total	384	316	82.3		
Age	<2 years	75	62	82.7		
	2-4 years >4	174	145	83.3	0.3596	0.835
	years	135	109	80.7		
	Total	384	316	82.3		

As depicted in table 5, the total prevalence of abomasal nematode, *Teladorsagia*, in sheep and goats was 79.95%. The prevalence of *Teladorsagia* in sheep and goats: 80.7% and 79.3% respectively, with sex: male (76.5%) and female (84.4%). Similarly the prevalence with age groups of study animals: <2 years (78.7%), 2-3 years (79.3%) and >4 years (81.5%).

Table 5: The prevalence of *Teladorsagia* based on species, sex and age categories

Variables		No. examined	No. positive	%positive	χ^2	P-value
Species	Sheep	181	146	80.7		
	Goats	203	161	79.3	0.1092	0.741
	Total	384	307	79.95		
Sex	Male	217	166	76.5		
	Female	167	141	84.4	3.7051	0.054
	Total	384	307	79.95		
Age	<2 years	75	59	78.7		
	2-4 years	174	138	79.3	0.3190	0.853
	>4 years	135	110	81.5		
	Total	384	307	79.95		

The total mixed infection of three abomasal nematodes (*H. contortus, T. axei* and *Teladorsagia*) in sheep and goats was 92.7%. The specific prevalence of mixed abomasal nematodes in: Spp of studied animals (sheep and goats) were 46.6% and 53.4%, sexes of studied animals (male and female) 55.3% and 44.7%, and age groups of studied animals (<2, 2-4, >4 years) 19.4%, 46.1% and 45.3% respectively (Table 6).

Table 6: The proportion of mixed infection by two or more nematodes

Variables		No. examined	No. positive	%positive	χ^2	P-value
Species	Sheep	181	166	46.6		
	Goats	203	190	53. 4	0.5021	0.479
	Total	384	356	92.7		
Sex	Male	217	197	55.3		0.098
	Female	167	159	44.7	2.7350	
	Total	384	356	92.7		
Age	<2 years	75	69	19.4		0.555
	2-4 years	174	164	46.1	1.1792	
	>4 years	135	123	45.3		
	Total	384	356	92.7		

DISCUSSION

Helminthosis is of considerable significance in a wide range of agro-climatic zones in sub Saharan Africa and constitute one of the most important constraints to small ruminant production.

This study indicated a very high overall prevalence of 94.5% (95% CI= 91.2-97.8%) and 97% (95% CI 94.7-99%) abomasal nematodes in sheep and goats respectively in Haramaya district of Eastern Hararrghe zone of Oromiya region. This is most probably due to the fact that sheep and goats of the area are managed under extensive management system with high stocking system density where large numbers of animals graze together during all months of the year, inadequate nutritional status and poor veterinary infrastructure and services of the area. The observed high prevalence of abomasal nematodes infection which is more than 90% prevalence coincides with the previous study reports of 95.6% and 100% in sheep and goats respectively (Abebe and Esayas, 2001), 92.9% and 90.2% in sheep and goats respectively (Kumssa and Wossene, 2006) abomasal nematodes from gastrointestinal nematodes from eastern part of the country and 90.40% and 77.7% of sheep and goats respectively (Murga, 2008) in Hawassa. There is also other postmortem studies carried out on gastrointestinal nematodes of small ruminants which is in line with the current study in postmortem examination prevalence rate of 100% in Illubabur (Bayou, 1992) ,90.9% and 94.85% in sheep and goats respectively in Gondar (Gebreyesus,1986), 96.43% in sheep and 94.52% of goats in Eastern Shoa (Melkamu,1991), 90% of sheep and 98.18% of goats in Wolaita Sodo, (Dereje, 1992), 93.3% of sheep in Asella (Yoseph,1993), 100% of sheep in Kombolcha (Genene, 1994), 95.55% of sheep and 90.50% of goats in Mekele (Getachew,1998) and 95.6% of sheep and 100% of goats in Eastern Ethiopia (Esayas, 1999). However the current study is inagreement with the gastrointestinal nematodes prevalence investigations in postmortem examination reports of Achenef (1997) in Debrebrehan (89.65%), 52.2% in Bale (Tesfalem, 1989) study carried out in high land area where as the current study was occurred in semiarid area and also the investigations of abomasal nematodes prevalence which was not in harmony with this study with the prevalence of less than the current study were El-Azazy (1995) and Wang *et al* (2006) in Saudi Arabia, which is desert where hot dry climate condition prevail, where as the present study was carried out in relatively semi-arid climate with variable amount of rain occurring during some months of the study period in Eastern Hararrghe zone and its surroundings.

Statistically significant difference in overall prevalence of abomasal nematodes in two species (*H. contortous* and *T. axei*) between sheep and goats ($P<0.05$) was recorded suggesting that both species of animals sharing the same environments are nearly equally susceptible to the nematodes (Kumsa and Wossene, 2006). However, no statistically significant difference ($P>0.05$) was observed in sex and age groups of the sheep and goats in all identified abomasal nematodes. This is due to GIT *helminthes* parasites affect both sexes equally (Assefa and Sissay, 1998) and equal opportunity of both sexes and age groups to exposure and they are from the same similar ecological area (Armour, 1980).

The overall prevalence of *Haemonchus contortous* species was 85.7% in both species and the specific prevalence of *Haemonchus contortous* was 90% in sheep and 82.8% in goats was identified as the most predominant abomasal nematode of the area. In support of this investigation result, earlier researchers reported that *haemonchus* constitutes the largest proportion of abomasal nematodes coinciding high prevalence rate by Abebe and Esayas (2001) 90.8% of both sheep and goats and, 90.82% of sheep and 96.55% of goats in Eastern Ethiopia, in Ogaden region from which *H. contortus* was 88.8%in goats, Brook (1983) 82.1% in Awassa, Kumssa and Wossene (2006) in Ogaden region (95.1% in sheep and 96.5% in goats), Abunna *et al* (2009) in Bishoftu (87.1% in sheep and 76.6% in goats), Esayas (1999) in Eastern Ethiopia (85.9% in sheep and 88.8% in goats), Murga (2008) in Hawassa (80% in sheep and 67.9% in goats), Dereje (1992) in Wolaita Sodo (80% in

sheep and 81.8% in goats),Ahmed(1988) in Wellega (88.23% in goats), Esayas (1988) in Ogaden (83.84% in goats), Naod *et al* (2006) in Hawassa (81.1%), Githiga *et al* (2001), Wang *et al* (2006) and El-Azazy (1995) 88.2%, Abebe and Esayas (2001).

Maing (1997) who regarded *Haemonchus* as the most important parasite against which worm control is primarily targeted in Kenya and Fakae (1990) who reported 77.8-100% prevalence in Nigeria. Although it occurs in mixed infections with other nematode parasites, it invariably dominates the faecal worm egg counts and often approaches 90% of worm egg contamination on pastures under prevailing conditions of high temperature and humidly, which is the norm in the humid tropics (Waller *et al*., 2004). Perry *et al* (2002) also described *haemonchus contortus* as the highly pathogenic nematode parasite of small ruminants and singled out as being of overwhelming importance. It is the blood- sucking parasite, responsible for acute outbreaks with mortalities.

The overall high prevalence of *Trichostrongylus axei* studied in both species of study animals was 82.3% and specifically high prevalence next to *haemonchus contortous* of 75.7% and 88.2% in sheep and goats respectively, in harmony with the previous investigations of Abunna et al, (2009) in Bishoftu (90.4% in sheep and 81.3% in goats), Murga (2008) in Hawassa (79.2 in sheep and 62.5% in goats), Dereje (1992) in Wolaita Sodo (81.8% in goats) and,Abebe and Esayas (2001) in Ogaden region (64.28%). However this study result inagreement with that of Ahimed (1988) in Wellega (29.4 in goats), Esayas (1988) in Ogaden (16.59% in goats), Dereje (1992) in Wolaita Sodo (10% in sheep), Genene (1994) in kombolcha (32.3% in sheep) and Achenef (1997) in Debrebrehan (51.72%) which were with lower prevalence and with the different climatic conditions.

The overall high prevalence of *Teladorsagia* studied in both species of study animals was 79.9% and the specific prevalence detected was with high respective prevalence of 80.7% and 81.3%in sheep and goats, was identified as the high prevalence rate following the two nematode parasites. Very few studies in Ethiopia have revealed the existence and prevalence of *Teladorsagia* infections in small ruminants (Amenu, 2005; Graber, 1975). The result of this study is in support of the reports made by the previous works of Abunna et al (2009) in sheep (82.5%) and in goats (75%) in Bishoftu. The prevalence of this parasite is relatively similar with the other studied parasites and the importance of it on the health and productivity of small ruminants should not over looked as the immature stages of this parasites are highly pathogenic to their host (Dunn, 1978). Moreover, this nematode has developed resistance to the most commonly used anthelmintics and it has become a challenge to small ruminant production. This result is higher than that of Naod *et al* (2006), who reported a respective prevalence of 19.4% and 20.5 *Teladorsagia* in sheep and goats in a study conducted in small ruminants at Awassa, Southern Ethiopia. This difference might be due to the difference in the detection ability of the parasites by the investigators and some other environmental factors.

CONCLUSION AND RECOMMENDATIONS

This study result indicated that abomasal nematodes are of the major helminthosis of small ruminants in Haramaya district, Eastern Hararghe zone, with high overall and specific prevalence of three abomasal nematodes (*Haemonchus, Trichostrongylus* and *Teladorsagia*) infection and these three nematodes are relatively equally affect the small ruminants of the area. The study revealed in the infected sheep and goats hemorrhage and damage of abomasal mucosa due to adult parasites. Most sheep and goats were infected by mixed type of infection with few animals showing pure infection and mildly infected followed by heavy infection with least moderate infection. Therefore, significant economic losses in production are expected to occur in the area. The findings of this study also indicate that management of worm in sheep and goats is important. However, farming systems such as communal grazing is largely practiced, and where other strategies are not available and may not be applicable, the option of the control of the worm is limited. Further investigation on biology and significance of vulvar morphology of *Haemonchus* spp. and epidemiological studies to determine the associated losses in domestic ruminants in all seasons in different agroecology and managements need to be considered.

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