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ARTICLE

Lungworms of Small Ruminants Slaughtered in Restaurants of Ambo, Oromia Regional State, Ethiopia

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SUMMARY

The present study was conducted in Ambo town from November 2010 through April 2011 with the objectives to determine the prevalence, identifying the species of lungworms involved and assess possible risk factors of lungworms in small ruminants. For this purpose, lungs and fecal samples from a total of 502 small ruminants were examined for the presence of lungworms. The overall prevalence of lungworms in the study area was 27.1% in goats and 91.7% in sheep. Animal species, sex, body condition, age and months of the study period were identified as risk factors for the occurrence of lungworms. Statistically significant (P<0.05) difference was noticed in the prevalence of lungworms between species of animals, among different age groups, months of the year and between sexes of animal in sheep. However, statistically significant difference in the prevalence of lungworms was not observed among different body condition and between sexes of animals in goats. *Dictyocaulus filaria (23.1%), Muellerius capillaris* (15.15) and mixed infection were identified during this study. The monthly overall prevalence of lungworm infection was significantly (P<0.05) higher in April (60.5%) in goats and in November and February (100%) in sheep. Significantly higher prevalence of *Dictyocaulus filaria* (47.1%), *Muellerius capillaris*(58.8%) and mixed infection (29.4%) in goats was observed in animals above three years of age. The findings of the current study suggested that lungworm infection in and around Ambo is an important constraint that requires strong attention.

KEY WORDS: Ambo, Lungworms, small ruminants, prevalence.

INTRODUCTION

Small ruminants provide as much as 30% of meat and milk consumed in sub-Saharan Africa; however, these animals received much less attention than cattle (ILCA, 1993). Small ruminants have a great potential to affect the social and economical development of the majority of African rural communities. They thrive on low quality feed, particularly fibrous vegetation, which can not be utilized by humans and non-ruminants such as poultry (Gatenby, 1995, Sefinew, *et al.*, 2006). Additionally their small size, high reproductive capacity, and rapid growth rates make them a more flexible short-term form of investment than cattle (ILCA, 1990). Sheep and goats are kept for the production of meat, milk, wool or hair, skins and manure.

In Ethiopia there are about 25.9 million sheep and 21.9 million goats (CSA, 2010) which play important role in the rural economy and enable the country to earn

substantial amount of foreign currency through export of skins and other by products. Sheep and goats cover more than 30% of all domestic meat consumption and generate cash income from export of live animals, meat, edible organs, and skin (Fletcher and Zelalem, 1991). Therefore, an increase in small ruminants production could contribute to the attainment of food self sufficiency in the country particularly in the response to protein requirement for the growing population as well as to increase foreign exchange earnings (Teferi, 2000). Inspite of the presence of this huge small ruminant population and their great contribution to the national economy, Ethiopia fails to optimally exploit these resources due to a number of factors including infrastructural problems, ill health, poor nutrition, poor production, poor husbandry, shortage of trained man power and lack of government policies for disease prevention and control (Teklye *et al*., 1987, Live stock Marketing authority, 2001).

Helminthosis is one of the important diseases contributing to losses in productivity (Agyei, 2003; Odoi *et al*., 2007) and health problems of goats and sheep and are usually associated with huge economic losses (Cernanska *et al*.,2005). Parasitic helminths also cause immunosuppression and enhance susceptibility to other diseases (Kumba *et al*., 2003; Tornia *et al*., 2004; Githigia *et al*., 2005).

Dictyocaulus filaria and *Dictyocaulus viviparus* and /or certain *Metastronglus* are known to exist in many African countries including Ethiopia (Tony, 2006). Lungworms cause infection of the lower respiratory tract, usually resulting in verminous bronchitis or verminous pneumonia. About half of all sheep deaths and morbidity on farms in highlands of Ethiopia are caused by pneumonia and endo-parasites (ILCA, 1993). The occurrence of parasitic diseases, including respiratory helminthosis varies greatly from place to place depending on the relative importance of the factors involved (Sefinew, *et al*., 2006). Control of these parasites is therefore, essential, to increase productivities of small ruminants. For proper implementation of control measures knowledge of parasitic diseases and their dynamics is critically important. In this regard, no study was conducted on the prevalence of lungworms of small ruminants in and around Ambo area.

Therefore, this study was initiated:

- to determine the prevalence of lungworms in small ruminants presented for slaughter at restaurants in Ambo
- to identify species of lungworms affecting sheep and goats
- to assess factors that might influence the occurrence of lungworm infection in small ruminants

MATERIALS AND METHODS

Study Area

The study was conducted in Ambo, located at about 110 kms west of Addis Ababa in west Shoa zone of Oromia regional state from November 2010 through April 2011. The area is situated at Latitude of 8°47' to 9°20' N and Longitude of 37°32' to 38°3' E. It has an altitude that ranges from 1300 to 3330 meters above sea level. It receives an annual rainfall of 800mm to 1000mm of which 70 % (longrain) falls from June to September and 30% (short rain) falls from February to April. The monthly average minimum and maximum temperatures are 15°c and 29°c, respectively. The study area constitutes 35.3% highland, 14.7% lowland, and 50% midland from the total coverage. The

agricultural scenario is dominated by mixed crop-livestock farming system in which crop production system dominates. The livestock population of the district is estimated to be 133, 202 cattle, 52,714 sheep, 43,339 goats, 9,655 horses, 15,456 donkeys, 294 mules and 138,754 poultries. There are also about 6,202 bee hives both in traditional and modern production system (Ambo district Livestock production, Health and Marketing Agency report, 2010).

Study Animals

The study animals were sheep and goats of mixed age groups, sexes and various body conditions brought from different location of west Shoa zone to different restaurants in Ambo town for slaughter. The breeds of sheep and goats were Horro and central highland breeds, respectively.

Study design and sample size determination

A cross-sectional study design was used to determine the prevalence of lungworm infection in small ruminants of the study area. The sample size was determined using the formula given by Thrustified (1995) as follows:

$$N=\frac{1.96^2 x Pexp(1-Pexp)}{D^2}$$

$$N=\frac{1.96^2 x 0.5(1-0.5)}{(0.05)^2}$$

Where; N= required sample size, Pexp=expected prevalence, D= desired absolute precision, N=384.

As there was no previous estimated prevalence of lungworm of small ruminants in the studied areas and to get the maximum sample size, 50% was considered as expected prevalence at 5% desired absolute precision. Hence the minimum sample size required for the current study was 384. However, 303 sheep and 199 goats were slaughtered in different restaurants during the study. Therefore, a total of 502 small ruminants were examined both coproscopic and post-mortem examination.

Study Methodology

Laboratory procedures involved for identification of L1 larvae was INEP method as described below and post-mortem examination was conducted according to the method described by Taylor *et al.* (2007). During sample collection information such as sex, age and body condition of the animal was recorded. Age of each the animals was determined by dentition as described by (Gatenby, 1995) and accordingly, the animals were categorized in to three age groups: Group 1 include animals less than one year of age, Group 2 includes animals of one year up to three years of age and group 3 includes animals more than three years of age.Based on body condition the animals were categorized in to three groups as fat (group 1), medium (group 2) and poor (group 3).

Faecal examination

Faecal samples were collected directly from the rectum from each study animals brought for slaughter. Collected faeces were kept in screw capped universal bottles and taken to Ambo University, department of Veterinary Laboratory Technology. Examination for the presence of L_1 larvae was conducted using INEP method: about 10gms of fresh faeces was weighed and wrapped with gauzes, fixed on a string-rod and submerged in a beaker filled with warm water of about 45°c which covers about ¾ of the feacal samples. Then the sample was kept overnight undisturbed for about 24 hours. Then the supernatant was discarded and the samples left at the

bottom was mixed well and poured into the petridish and examined under stereomicroscope for the presence of moving L_1 of lungworms (Taylor *et al.*, 2007). When it was positive, few drops taken by pipette and put on a glass slide by adding a drop of 1% iodine to immobilize the larvae and covered with a cover slip, then examined under 10 x and 40x magnification power for species identification (Taylor *et al.*, 2007). The larvae (L1) of *Dictyocaulus filaria* is larger in size, brown in color due to food granules in their intestinal cells with cranial cuticular knob and blunt tail while L_1 of *Muellerius capillaris*is smaller in size, whitish in color with "S" shaped tip and dorsal spine and L1 of *Protostrongylus* is .also whitish in color smaller in size with "S" shaped tip that is similar with L_1 of *Muellerius capillaris* but without dorsal spine.

Post-mortem examination

The lungs were palpated for the presence of *Metastrongyloid* nodules, which are usually grayish white in color. If present, they were trimmed off and worms extracted from the tissue by gentle compression of a small nodule or part of large nodule between two glass slides, and then carefully teasing the worm away from the tissues with thumb forceps. The air passages were opened starting from the trachea down to the small bronchioles with fine blunt pointed scissors to detect adult parasites (Taylor *et al.*, 2007). The species of adult lungworms was identified as *Dictyocaulus filaria* which is thread like, whitish in color, larger in size and found in the trachea and bronchi of the infected lungs of small ruminants while *Muellerius capillaris*is hair like, brown in color, smaller in size and found in the bronchioles and embedded in the lung tissue of the infected animals. *Protostrongylus*is also smaller in size, red in color, and found in the bronchioles and embedded in the lung tissue of infected animals.

differs from the report of Sissay (1996) in Bahirdar. This could be explained by the fact that *Dictyoucalus filaria* follows a direct life cycle and takes less time to reach the infective stage and after ingestion, larvae can appear in the faeces with in five weeks (Soulsby, 1982). However, the transmission of *Mullerius capillaris* is epidemiologically complex as it involves intermediate host.

Higher prevalence of *Dictyoucalus filaria* and *Mullerius capillaries* was observed during the rainy season than the dry season.
Significantly higher prevalence was observed in female sheep than male for *Dictyoucalus filaria* and mixed infection. This finding is in agreement with the previous reports of Sisay (1996) and Sefinew *et al.* (2006).

Significantly higher prevalence ($p<0.05$) of *Dictyoucalus filaria, Mullerius capillaries* and mixed infection, respectively was observed in goats and *Mullerius capillaries* in sheep above three years of age and the lowest prevalence was observed in animals under one year of age for the same infection of lungworm species. This finding is in agreement with Alemeyehu *et al.* (2009), Berrag and Urquhart (1996) and Frewangel (1995). Berrag and Urquhart (1996) indicated that development of *Muelleris* species in the lungs of small ruminants is associated with marked tissue damage and pronounced cellular reaction.

Infections due to *Mullerius capillaries* tend to be cumulative over time; as a result, older animals are more likely to exhibit clinical signs of coughing and ill-thrift due to heavy infection than younger animals.

Tables

TABLE I. Overall prevalence of lungworms by age, sex and body condition in sheep and goats.

Animal species		Animal sex		Animal body condition			Animal age group		
Goats	Sheep	Male	Female	good	Medium	Poor	<1year	1-3 years	>3 years
27.1%	91.7%	47.3%	71.4%	55.0%	63.9%	77.3%	34.4%	70.0%	90.9%
P=0.000		P=0.000		P=0.025			P=0.000		

TABLE II. Prevalence of lungworms by sex in sheep and goats by coproscopic examination.

		Species of parasite		
Animal species	**Sexes of animal**	***D.filaria***	***M.capillaris***	**Mixed**
Goats	Male	24.6% 17/69	8.7% 6/69	7.2% 5/69
	Female	22.3% 29/130	18.5% 24/130	11.5% 15/130
P value		P=0.711	P=0.067	P=0.338
Sheep	Male	73.2% 30/41	63.4% 26/41	48.8% 20/41
	Female	85.9% 225/262	79.4% 208/262	73.3% 192/262
P value		P=0.038	P=0.023	P=0.001

TABLE III.Prevalence of lungworms in small ruminant by age groups by using coproscopy.

Animal species		**Species of parasite**		
	Age groups	***D.filaria***	***M.capillaris***	**Mixed**
	< 1 years	17.4% 24/138	6.5% 9/138	5.1% 7/138
	1-3 years	31.8% 14/44	25.0% 11/44	18.2% 8/44
	>3 years	47.1% 8/17	58.8% 10/17	29.4% 5/17
	Total	23.1% 46/199	15.1% 30/199	10.1% 20/199
	P value	P=0.007	P=0.000	P=0.001
Sheep	< 1 year	24.4% 11/45	53.3% 24/45	46.7% 21/45
	1-3 years	92.9% 52/56	78.6% 44/56	76.8% 43/56
	> 3 years	83.7% 169/202	82.2% 166/202	73.3% 148/202
	Total	84.2% 255/303	77.2% 234/303	70.0% 212/303
	P value	P=0.057	P=0.000	P=0.001

TABLE IV . Monthly Prevalence of lungworms in sheep and goats by post-mortem examination

	Animal species					
	Goats			Sheep		
Months	*D.filaria*	*M.capillaris*	Mixed	*D.filaria*	*M.capillaris*	Mixed
Nov	0.0% 0/18	0.0% 0/18	0.0% 0/18	100% 4/4	100% 4/4	100% 4/4
Dec	13.3% 4/30	10.0% 3/30	6.7% 2/30	89.3% 50/56	94.6% 53/56	12.5% 7/56
Jan	12.3% 7/57	3.5% 2/57	0.0% 0/57	88.3% 68/77	85.7% 66/77	76.6% 59/77
Feb	43.5% 10/23	30.4% 7/23	30.4% 7/23	100% 35/35	100% 35/35	100% 35/35
March	14.3% 4/28	3.6% 1/28	3.6% 1/28	88.5% 23/26	61.5% 16/26	60.0% 15/26
April	44.2% 19/43	37.2% 16/43	20.9% 9/43	48.6% 51/105	59.0% 62/105	48.6% 51/105
Total	21.1% 44/199	14.6% 29/199	9.5% 19/199	84.2% 255/303	76.6% 232/303	69.2% 209/303
P value	P=0.000	P=0.000	P=0.000	P=0.000	P=0.000	P=0.000

TABLE V . Prevalence of lungworms in small ruminant by age groups using post-mortem examination

Animal species	Age group	Species of parasites		
		D.filaria	*M.capillaris*	Mixed
Goats	< 1 years	15.9% 22/138	6.5% 9/138	5.1% 7/138
	1-3 years	31.8% 14/44	22.7% 10/44	18.2% 8/44
	>3 years	47.1% 8/17	58.8% 10/17	29.4% 5/17
	Total	22.1% 44/199	14.6% 29/199	10.5% 20/199
	P value	P=0.003	P=0.000	P=0.001
Sheep	< 1 years	80.0% 36/45	53.3% 24/45	46.7% 21/45%
	1-3 years	92.9% 52/56	76.8% 43/56	76.8% 43/56
	>3 years	82.7% 168/202	81.7% 165/202	73.3% 148/202
	Total	84.2% 255/303	76.6% 232/303	70.0% 212/303
	P value	P=0.129	P=0.000	P=0.001

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