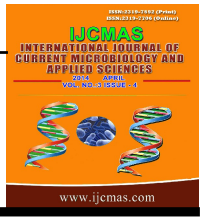
International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 4 (2014) pp. 1139-1152**
http://www.ijcmas.com



Original Research Article

On farm and Abattoir study of Lungworm infection of small ruminants in selected areas of Dale District, Southern Ethiopia

Serkalem Kebede, Sissay Menkir and Mulugeta Desta*

Department of Biology, College of Natural and Computational Science, Haramaya University, Haramaya, Ethiopia
**Corresponding author*

A B S T R A C T

A cross-sectional study was carried out in Dale district of southern Ethiopia from February – April, 2012 to determine the prevalence and the predominant species of lungworms in sheep and goats; and to relate lungworm infection with age, sex, species, breed, and body condition of animals in the study area. Faecal samples were randomly collected from 200 sheep and 200 goats in Dale district to examine first stage larvae (L1) using Modified Baerman technique. In addition, 384 whole lungs of sheep and goats (240 sheep and 144 goats) were systematically collected from Yirgalem municipal abattoir and they were subjected for postmortem examination to detect the presence of adult lungworm parasites. The prevalence of lungworm infection of sheep and goat in faecal examination was (62%) and (59.5%), respectively and similarly, in postmortem examination it was (56%) for sheep and (66%) for goat. The overall prevalence of lungworm infection in sheep and goat based on coprological and postmortem examinations was (60.8%) and (55.2%), respectively. The predominant lungworm species identified by the faecal and postmortem examination was Dictyocaulus filaria with the prevalence rate of (26%) and (22.9%), respectively. The sex of animals in both farm and abattoir study did not show significant association with the prevalence of lungworm infection ($p > 0.05$). Statistical analysis of both farm and abattoir indicated that there was a significant difference in the prevalence of lungworm infection between the age group categories ($p < 0.05$). The highest prevalence was observed in age groups of young and the lowest in adult age groups of both sheep and goats. The body condition of animals was found to be significantly associated to the prevalence of lungworm infection ($p<0.05$) and the association of lungworm infection in sheep and goats by body condition score was significantly highest in animals with emaciated body conditions than average or fat body condition scores. The present study confirmed that lungworm infection was common problem of sheep and goat in the study area. To reduce lungworm infection early treatment in young sheep and goat and feed those animals having very thin and thin body condition should be conducted.

Keywords

Abattoir, Coprology, Dale district, Farm, Lungworm, Postmortem examination, Prevalence, Small Ruminants, Southern Ethiopia

Introduction

Lungworms are widely distributed throughout the world but are particularly common in countries with temperate climates, and in the highlands of tropical and sub-tropical countries (Armour, 1980). The species of importance in ruminants

belongs to two different families; the Dictyocaulidae and the Metastrongylidae. The Dictyocaulidae include *Dictyocaulus viviparus* in cattle and buffaloes, and *Dictyocaulus filaria* in sheep and goats. These worms are 5-10 cm long and live in the trachea and bronchi. The Metastrongylidae are represented by at least three species in small ruminants. *Protostrongylus rufescens* is a small worm (1.5-3.5 cm) found in the bronchioles, *Muellerius capillaris* (1.2-2.5 cm) which is located in the alveoli, and *Cystocaulus ocreatus* (2-5 cm) is found in the terminal bronchioles. An infection of the lower respiratory tract by any of these nematodes of species may result in bronchitis or pneumonia or both (Kahn, 2005). *Dictyocaulus, Mullerius* and *Protostrongylus* are the most important and widely distributed respiratory tract helminthes of sheep and goats. Among these parasites, *Dictyocaulus filaria* is mostly the cause of verminous pneumonia (Torney, 1989). Dictyocaulidae and some Metastrogylidae are reported from several countries in Africa.

Verminous pneumonia due to *D. filaria* in sheep and goats is very important both economically and pathologically in affecting productivity and health of these animals The prevalence of lungworm species of small ruminants was not widely studied in Southern Ethiopia. However, the climatic factors, altitude, intermediate hosts and ecological conditions were favorable such as rain fall, humidity, temperature, marshy area for grazing, sheep and goat management system for the development of lungworm species in Dale district. Therefore, it is important to know the detail information on the epidemiology of the parasite at farm level and abattoir survey to determine its current status in selected areas of Dale district Southern Ethiopia.

Materials and Methods

Description of the Study Area

The study was conducted on selected areas in Dale district and in Yirgalem municipal abattoir in small ruminants. Yirgalem is located in the Sidama Zone 365 km South of Addis Ababa. The District is subdivided into 36 peasant associations. According to CSA (2011), it is located at $6^0$44' to $6^0$84' N and $37^0$92' to $38^0$60' E with an altitude range of 1001–2500 m.a.s.l. This district has diverse agro-ecological zones, and receives an annual mean average rainfall of 1170 mm (SEDPSZ, 2004). The average annual temperature is 19^0_C. There are two cropping seasons in the area; "Belg" (short rainy season) from March to April and "Meher" (main rainy season) from June to September. In the study area, Enset plays a central role in the life of Sidama people of Dale district. It provides the main staple food of people and potentially available livestock feed throughout the year. The current sheep and goat population in Dale district is 20,285 and 14,022 respectively (SNNPRS–RSA, 2011).

A cross-sectional study from February 2012 up to April 2012 was conducted to determine the prevalence and the predominant species of lungworms of sheep and goats; and to relate lungworm infections with age, sex, species, breed, and body condition of the animals in the selected areas in Dale district and Yirgalem town, Southern Ethiopia. The explanatory variables considered were age, sex, and species of animal, breed, location (origin) and body condition.

Study Animals

The study was conducted in areas where sheep and goats are managed by farmers and those presented for slaughter at

Yirgalem municipal abattoir. The study population comprisesed sheep and goat at different sex, age, body condition category and breed. The data collection was achieved through discussion with the animal owners in each peasant association and with assistance of district Agricultural offices, animal health professionals, peasant association leaders and other concerned bodies.

Determination of Sample Size

Random sampling technique was used to collect faecal samples and systematic sampling was used for abattoir study. To calculate the sample size, the following parameters were used: 95% level of confidence (CL), 5% desired level of precision and with the assumption of 50% expected prevalence of lungworm in sheep and goats. Sample size was determined using the formula given by (Thrusfield, 2007). A total of 400 samples were collected for faecal examination and 384 were collected for abattoir survey.

Method of Data Collection

The faecal and lungs were collected from selected PA and Yirgalem Municipal abattoir during the study period (February-April, 2012). At the time of collection, necessary data was recorded including age, sex, species, body condition, location/origin, and breed. Then, the faecal samples were transported to Yirgalem Veterinary Health Center for laboratory examination. Postmortem data collection was done by inspecting lung during postmortem examination process in the abattoir.

Body condition scoring and determination of age and sex

Body condition scoring

Body condition of each animal was determined based on the criteria set by Thompson and Meyer (2002). Using the 5 point scale (1=very thin to 5=very fat). Animals were visually assessed followed by palpation of the area around the lumbar vertebrae between the back of the ribs and the front of the pelvic bones.

Determination of age: Age of every sampled sheep and goats was determined based on dentition. Those which have not erupted permanent incisor teeth, were classified as young, while those with one pair or more permanent incisor teeth were classified as adults (Gatentby, 1991; Steele, 1996).

Faecal sample collection and laboratory diagnosis

Faecal sample collection

out of 36 peasant associations of Dale district, five PAs were purposively selected namely: Manche, Boa, Awada, Soyama and Ajawa by considering their sheep and goat population and transport access. The households and individual animals were selected randomly from each peasant association. Accordingly; equal proportion of animals, i.e. 400 small ruminants (200 sheep 200 goats) were selected for the study.

During sampling, age, sex, species, location, breed and body conditions of the animals were recorded. Faecal samples were collected directly from the rectum of all selected animals using disposable gloves and stored in plastic bag under the ice box and then taken to Yirgalem Veterinary Laboratory for processing. Each plastic bag was properly labeled corresponding to the animal (Soulsby, 1982; Urquhart *et al*., 1996).

Laboratory diagnosis

The techniques recommended by Fraser (1991) and Urquhart *et al*., (1996) were employed for identification of lungworm species from the collected samples. In the laboratory, following conventional method of Baerman technique for detection of lungworm larvae, 5-10g of fresh faeces were weighed from each sample for the extraction of first stage (L1) larvae. The feces were fully enclosed in gauze fixed with two applicator sticks that pass through the rubber band and rest on the edges of the funnel glass. The glass was filled with clean lukewarm water (40 - 45^0c warm water) until the sample become submerged making sure that the corner of the gauze did not hang over the edge of the funnel. The whole apparatus were left overnight and then the sediment was examined under the low power of a compound microscope based on the morphology of the larvae (Anne and Gray, 2006).

Abattoir Survey

A total of 384 animals (240 sheep and 144 goats) were sampled during the study period at Yirgalem municipal abattoir. Systematic sampling technique three days per week visit was used to select the study sheep and goat in the abattoir for three months.

Ante-mortem inspection

Pre-slaughter examinations of study animals were conducted and species, age, sex, breed and
body condition of each animal were recorded.

Post-mortem examination

Collection of lungs

lungs were collected for postmortem examination, identification of adult lungworms. The collected lungs were examined immediately after slaughter at Yirgalem Veterinary Laboratory.

Inspection of lungs

the collected whole lungs of each animal were taken to the laboratory for examination of parasitic nodules. All suspected nodules were examined in detail by dissection. The trachea and bronchial tree were opened with a pair of scissors, searched for the presence of adult worms and all visual parasites were collected.

Microscopic examination and identification of lungworms:

identification of lungworm was performed using the features. *D. filaria* was occured in the trachea, bronchi and bronchioles of sheep and goats. This lungworm is slender, thread like nematodes, white in color with knob on head. *M. capillaris* was occured in the lung (bronchi, bronchioles and alveoli). This lungworm is small hair like with bent tail. *P. refescens* adults were found within the bronchioles, grey reddish in color and have wavy tail. The collected Parasites were examined using a compound microscope (Maximov, 1982).

Data Management and Analysis

The data was entered and managed in MS Excel work sheet and analyzed by using SPSS Version 16. The prevalence of lungworm infection was determined by dividing the total number of animals positive to lungworms to the total number of examined animals multiplied by 100 (Thrusfield, 2007). The significant association between the prevalence of lungworm and explanatory variables was determined using Chi-square test (χ^2). The explanatory variables included were species, sex, age, body condition and their associations with the level of prevalence were described. The difference was regarded as significant if P-value is <0.05 at 95% confidence interval.

Results and Discussion

Prevalence of lungworm infections of sheep and goats owned by smallholder farmers in dale district, Southern Ethiopia

The result of prevalence rates of lungworms in examined sheep and goat owned by smallholder farmers in the study area was summarized here below.

The sex of animals did not show significant association with lungworm infection (χ^2 = 0.014, p=0.905).The prevalence of lungworm infection in young sheep 75.6% was significantly greater than (χ^2 =11.934, p = 0.003) in adult sheep 51.8%. Similarly, the prevalence rate of lungworm infection in young goat 75.6% is significantly higher than (χ^2 = 13.859, p=0.001) that of the adult goat 46.4% in the study place during the study period.

As the result shown in table 1, the overall prevalence of lungworm infections in examined sheep and goat was 60.8% (62% for sheep and 59% for goat).This finding is almost in close agreement with the result of those of other researchers in different parts of Ethiopia, who also reported the prevalence of infection as 59.4% in northern Ethiopia by Uqbazghi (1990), 58% prevalence of lungworm infection was reported by Wendewosen (1992) who conducted a study in Assela, 53.6% by Sefinew (2006) were reported in northeastern Ethiopia and 57.1% by Mihretab (2011) in Tyo district, south East Ethiopia.

The overall prevalence rate (60.8%) of the present study was lower than the prevalence reported by Netsanet (1992) in Debrebrihan who reported 73.3% and Eyob (2008) in Assella, where the prevalence rate was 72.44%. The result of the present work is supported by Abdukadir (2009) in and around Kombolcha, Feyesa Regassa *et al.,* 2010; Alemayehu *et al*., (2010) in Dessie and Kombolcha district northeastern Ethiopia, Mekonnen *et al*., (2011) at Gondar town, Nuraddis and Yared (2012) at Jimma town and Dawit (2012) in Mekele town who reported the prevalence of 42.96%, 40.4%, 33.83%,13.4% and 26.7%, respectively. The variation in the overall prevalence rate in different areas might be due to differences in nutritional status, level of immunity, management practice of the animal, rain fall, humidity and temperature differences and season of examination on the respective study area.

The overall prevalence of lungworm infection in examined male and female animals was (61.1 and 61%), respectively. In both species (sheep and goat) there was no significant differences (χ^2 = 0.014, p=0.905) in prevalence of lungworm infection between male and female animals. This coincides with the previous reports of Uqubazgi (1990), Netsanet

(1992) in which all the cases there was no statistically significant variation between sexes of sheep and goats (χ^2 = 0.014, p=0.905). But, Sissay (1996), were reported that the sex of animals showed significant association with the prevalence of lungworm infection (p<0.05) between male and female animals. The prevalence of lungworm infection in young sheep, was significantly greater than (χ^2 =11.934, p = 0.003) in adult sheep, (51.8%), similarly, the prevalence rate of lungworm infection in young goat was significantly higher than (χ^2 =13.859, p=0.001) that of the adult goat, (46.4%) in this study.

Statistical analysis indicated that there was a significant difference (χ^2 =11.934, p = 0.003) in the prevalence of lungworm infection between the age categories. These findings were in agreement with Uqbazghi (1990) who conducted a research in Hammassin Awraja of Ethiopia. Kids and lambs are known to be more susceptible than adults and there was a tendency for the worm burdens in goat and sheep to decrease with increasing age because the acquired immunity developed in older animals due to previous exposure of sheep and goat that recovered from the infection has better immunity against re-infection.

Association of lungworm infections with body condition of sheep and goat

The body condition of animals was found to be significantly associated to the prevalence of lungworm infection (χ^2 = 10.246, p = 0.017). A higher infection rate was observed in animals having very thin body condition as compared to other groups. A significant difference was also observed in the infection rate between very thin, 78.9% thin, (65.6 %) compared to average, (57.1%) and fat, (40%) in both species.

The prevalence was significantly highest in animals with very thin and thin body conditions than in those with average or fat body conditions. The findings of the present studies was in line with Mihretab (2011), who reported that the prevalence was significantly highest in animals with the odds of poor body conditions than in those with medium or good body conditions in her survey. The achievable explanation for this observation could be due to immune-suppression in sheep and goat with very thin and thin body conditions, concurrent infection by other parasites including GIT helminthes and/or malnutrition (Thomson and Orita, 1988). Poorly nourished sheep and goat appear to be less competent in getting rid of lungworm infection. Evidently, the infection with a parasite by itself might results in progressive emaciation of the animals (Radostits *et al,* 2007).

Prevalence of lungworm infections of sheep and goat by study farms

There was a significant association (χ^2 =17.392, p = 0.043) of the prevalence rate with Peasant Associations. The highest prevalence of lungworm infection of sheep and goats was registered in Soyama Peasant Association 68.7% and the lowest prevalence of lungworm infection 44.0% was observed in Boa Peasant Association
The significant difference in each peasant association might be due to management practice of small ruminants. In addition to this, slight variation in each PAs except Boa all have similar agro- ecology while Boa was located in relatively low land agro-ecology than others.

Major lungworm species identified on coproscopy

Dictyocaulus filaria was the most

predominant lungworm species in Dale district with a prevalence rate of 24% in sheep and 28% in goat, followed by *M. capillaris* 19% in sheep and 18% in goat and finally, the least prevalence was *P. rufescens* having a prevalence of 12% in sheep and 8% in goat.

Three major important respiratory nematodes were identified in examined both sheep and goats: *Dictyocaulus filaria* (26%), *Mulleries capillaries* (18%) and *Protostrongylus refescens* (10%). In this study, it was observed that *D. filaria* was the most predominant lungworm species with the prevalence rate of 26% followed by *M. capillaries* (18%), where as *P. rufescens* (10%) was the least predominant. This finding was in line with Tarazona (1984),Netsanet (1992),Rehbein *et al.*,(1998), Nemat and Moghadam (2010), Dawit (2012) , Cabaret, J 2009 and Nuraddis and Yared (2012) In contrast to this finding, Sissay (1996) conducted research in Bahirdar and Mezgebu (1995) in Addis Ababa reported that *M. capilaris* was the most prevalent species. The possible explanation for the predominance of *D.filaria* in the study area might be attributed to the difference in the life cycles of the parasites. Thus, *D. filaria* has a direct life cycle and requires shorter time to develop to an infective stage. After ingestion, the larvae of these parasites can be shed with feces within 5 weeks (Soulsby, 1982).Unlike to *D. filaria*, the transmission of *P.rufescens* and *M.capillaris* is epidemiologically complex event involving host, parasite and intermediate host. Because, *P. refescens* has indirect life cycle that requires longer time and wet or rainy warmer season to complete their complex life cycle in the presence of suitable intermediate hosts that create favorable condition for sporadic distribution. On the other hand, the low prevalence rate of *M. capilaris* and *P. rufescens* in the study area might be contributed to the fact that the study was done in Autumn ("belg" - which was short rainy season) which does not favor the development of the snail intermediate hosts, (Kahn, 2005).With regard to animal species *D. filaria* was relatively higher in goats 28% than in sheep (24%).This variation could be explained by the fact that goats are more susceptible to helminthes than sheep due to their browsing behavior. Goats with their browsing behavior consume uncontaminated matter with parasite larvae, so being less exposed to larvae and therefore they have lower acquired resistance than sheep (Wilsmore, 2006). Out of 240 sheep and 144 goats slaughtered. The overall prevalence of lungworm infection was 55.2%.

There was no significant association (χ^2=2.730, p= 0.255 and χ^2=2.258, p= 0.323) between sex groups. The overall prevalence rate (55.2%) of the present study was lower than the work of Sefinew (2006) at Dessie and Kombolcha abattoir who reported 66.3% and Girişgin (2008) who conducted a study in Bursa Province of Turkey who reported 62.5% but the result of the present work was higher than the observation of other works; Mekonnen *et al*., (2011) at Gondar town in different restaurants who reported 32.6%, Dawit (2012) in Jimma abattoir 29.2%, and Nuraddis and Yared (2012) at Mekelle town who reported 15%.

The prevalence of male and female animals (sex groups) of sheep and goats were 56.6% and 66.6%, respectively in (Table 5).There was no significant association in the overall prevalence of lungworm infection between two sexes (χ^2=2.730, p = 0.255 and χ^2=2.258, p =

0.323), respectively. The ages of sheep and goats show significant association with the prevalence of lungworm infection. The prevalence of lungworm infection in young sheep, 68.6% is infection rate with increasing age of the animal. The infectivity of young sheep and goats were higher than adult sheep and goat, this was common in both faecal and abattoir examination. Similar to significantly greater than (χ^2 = 19.782, p= 0.000) in adult sheep, 40.8% (Table 8). Similarly, the prevalence rate of lungworm infection in young goat 70.6% is significantly higher than (χ^2 =18.310, p= 0.000) that of the adult goat, 36.8% in the study place during the study period. The result showed decrease farm study all sampled sheep and goat populations were indigenous.

Association of lungworm infections with body condition of sheep and goat

The association of lungworm infection with body condition scores was highly significant (χ^2= 45.755, P= 0.000) (Table-8) .In those sheep and goat with thin body condition 74.5 and 71 % and than in those with average 53.5 and 42.5 or fat 22 and 30.8%, respectively. The effect of lungworm infection in sheep and goats by body condition scores on the prevalence of lungworm infections, the prevalence was significantly highest in animals with thin and average body conditions than fat body conditions.

The result of this study revealed a prevalence rate of, emaceted 73.1%, average 48.9% and fat animals. In the present study higher than a result obtained by Dawit (2012) in Jimma abattoir who reported poor (thin) medium (average) and good fat animals in both species of sheep and goats. In present study thin and average animals were highly infected with lungworms as compared to sheep and goats with fat body condition. This is in agreement with the report of Wamae (1991). Poor nutrition lowers the resistance of the animal thus, enhancing the establishment of worm burdens and increasing pathogenesis of the parasites. Consequently, worm burdens tend to be higher in poorly-feed than in well-feed animals (Wamae, 1991). The predominant species of lungworm in sheep and goats (both species) was *D.filaria* 22.9% followed by *Mulleries capillaries* 18.7%, the least was *P. refescens* 9.1% as indicated by postmortem examination. (Table 7)

The result of this study was in line with Dawit (2012) in Jimma abattoir, Nuraddis and Yared (2012) at Mekelle town also reported *D. filaria*. Contrast to *D. filaria,* the epidemiologically transmission of *P.rufescens* and *M.capillaris* is complex involving host, parasite and intermediate host. In addition to this, the low prevalence of both *M. capillaris* and *P. rufescens* small ruminants slaughtered in the abattoir might came from a wide range of different peasant association surrounding the Dale district and the dry season of the study period does not favor the development of the snail intermediate hosts (Radostits *et al*., 2007).

Lungworm count from the infected lung of sheep and goat slaughtered at Yirgalem municipal abattoir

count was seen for *D. filaria* and *P. rufescens*, respectively.

The present result was supported by Sefinew *et al*. (2006) who reported the mean worm burden of *D. filarial, Mullrius capillarie*s and *P. rufescens* as 23.3, 49.7 and 9.8, respectively. According to Sefinew *et al*. (2006), the total mean worm

Table.1 Prevalence of lungworm infections; in sheep and goats owned by smallholder farmers by species, sex and age of examined animals during February- April, 2012

Species and sex	Adult		Young		Both age group			
	№ Examined	№ Positive (%)	№ Examined	№ Positive (%)	№ Examined	№ Positive (%)	χ^2	p-value
Sheep								
Male	18	6(33.3%)	37	27(73%)	55	33(60%)		
Female	96	53(55.2%)	49	38(77.6%)	145	91(63%)		
Total	114	59(51.8%)	86	65(75.6%)	200	124(62%)	0.389	0.823
Goat								
Male	37	17(45.9%)	47	35(74.5%)	84	52(62%)		
Female	73	34(46.6%)	43	33(76.7%)	116	67(57.8%)		
Total	110	51(46.4%)	90	68(75.6%)	200	119(59.5%)	0.613	0.736
Both species								
Male	55	23(41.8%)	84	62(74%)	139	85(61.1%)		
Female	169	87(51.5%)	92	71(77.2%)	261	158(61%)		
Total	224	110(49.1%)	176	133(75.6%)	400	243(60.8%)	0.014	0.905
Age of sheep	χ^2 =11.934, p= 0.003							
Age of goat	χ^2 = 13.859, p=0.001							

95% CI Sex and Age: Sheep M= 45.90-72.97, F=54.34-70.63 and age Y=65.12-84.20, A=42.20-61.21.Goat M=50.65-72.28, F=48.23-66.87 and age Y=65.36-84.00, A=36.80-56.12.

Table.2 Association of prevalence of lungworm infection with body condition scores of examined sheep and goat in Dale district, Southern Ethiopia during February-April, 2012

Body condition category	Species								
	Sheep (N=200)		Goat (N=200)		Both species (N=400)				
	Frequency	No. positives (%)	Frequency	No. positives (%)	Frequency	No. positives (%)	95% CI	χ^2	p-value
Very thin	30	24(80%)	8	6(75%)	38	30(78.9%)	56.85-90.44		
Thin	64	44(68.7%)	67	42(62.6%)	131	86(65.6%)	56.85-73.72		
Average	90	50(55.5%)	106	62(58.4%)	196	112(57.1%)	49.89-64.17		
Fat	16	6(37.5%)	19	9(47.3%)	35	15(42.8%)	26.32-60.64		
Total	200	124(62.0%)	200	119(59.5%)	400	243(60.8%)	55.77-65.56	10.246	0.017

Table.3 Prevalence of lungworm infection of sheep and goat by smallholder farms (peasant association) in Dale district, Southern Ethiopia, from February -April, 2012

Location of animals	Species	Number of animals		95% CI	χ^2	p-value
		№ Examined	№ Pos (%)			
Manche (N=88)	Sheep	46	31(67.4%)	51.98-80.46		
	Goat	42	24(57.1%)	40.96-72.27		
	Total	88	55(63.0%)	51.53-72.59		
Boa (N=50)	Sheep	25	15(60.0%)	38.66-78.87		
	Goat	25	7(28.0%)	12.07-49.38		
	Total	50	22(44.0%)	29.99-58.74		
Awada (N=83)	Sheep	43	24(55.8%)	39.87-70.92		
	Goat	40	28(70.0%)	53.46-83.43		
	Total	83	52(62.7%)	51.34-73.02		
Soyama (N=99)	Sheep	32	22(68.8%)	49.99-83.88		
	Goat	67	46(68.7%)	56.16-79.44		
	Total	99	68(68.7%)	58.58-77.63		
Ajawa (N=80)	Sheep	54	32(59.3%)	45.03-72.43		
	Goat	26	14(53.8%)	33.37-73.41		
	Total	80	46(57.5%)	45.93-68.48		
Overall total		400	243(60.8%)	55.77-65.56	17.392	0.043

Table.4 Lungworm species identified in examined sheep and goat of smallholder farmer in Dale district based on examination of faecal samples

Types of infection	Species		Both species(N=400)	
	Sheep (N= 200)	Goat (N =200)		
	№ Positives (%)	№ Positives (%)	№ Positives (%)	95% CI
Dictyocaulus filarial	48(24%)	56(28%)	104(26%)	21.76-30.59
Mullerius capillaries	38(19%)	35(18%)	73(18%)	14.58-22.39
Protostrongylus rufescens	24(12%)	16(8%)	40(10%)	7.24-13.30
Mixed				
Df + Mc	10(5%)	9(4.5%)	19(4.8%)	2.88-7.31
Df + Pr	3(1.5%)	0(0%)	3(0.75%)	0.15-2.17
Mc + Pr	1(0.5%)	3(1.5%)	4(1%)	0.27-2.54
Total	124(62%)	119(59.5%)	243(60.8%)	55.77-65.56

Df: *Dictyocaulus filaria*, Mc: *Mullerius capillaris*, Pr: *Prototostrongylus rufescens*

Table.5 The prevalence of lungworm infection of sheep and goats by species, sex and age during postmortem examination

	Adult		Young		Both age group			
Species and Sex	№ Examined	№ Positive (%)	№ Examined	№ Positive (%)	№ Examined	№ of Positive (%)	χ^2	p-value
Sheep								
Male	90	33(36.7%)	118	81(68.6%)	208	114(54.8%)		
Female	13	9 (69.2%)	19	13(68.4%)	32	22(68.8%)		
Total	103	42(40.8%)	137	94(68.6)	240	136(56.6%)	2.730	0.255
Goat								
Male	59	20(33.9%)	55	37(67.3%)	114	57(50%)		
Female	17	8(47.1%)	13	11(84.6%)	30	19(63.3%)		
Total	76	28(36.8%)	68	48(70.6%)	144	76(66.6%)	2.258	0.323
Both species								
Male	149	53(35.6%)	173	118(68.2%)	322	171(53.1%)		
Female	30	17(56.6%)	32	24(75%)	62	41(66.1%)		
Total	179	70(39.1%)	205	142(69.3%)	384	212(55.2%)	3.085	0.079
Age of sheep	χ^2 =19.782, P= 0.000							
Age of goat	χ^2 = 18.310, P= 0.000							

95% CI Sex and Age: Sheep M= 26.75-47.48, F=38.57-90.90 and age Y=60.13-76.26, A=31.19-50.90.Goat M=22.08-47.39, F=22.98-72.18 and age Y=58.29-81.02, A=26.05-48.68.

Table.6 Association of prevalence of lungworm infection with body condition scores of examined sheep and goat in Yirgalem Municipal abattoir during February-April, 2012

Body condition categories	Species				Both species (N=384)		95%CI	χ^2	p-value
	Sheep(N=240)		Goat(N=144)						
	Frequency	No. of positives (%)	Frequency	No. of positives (%)	Frequency	No. of positives (%)			
Thin	98	73(74.5%)	58	41(71%)	156	114(73.1%)	65.39-79.85		
Average	101	54(53.5%)	73	31 (42.5%)	174	85 (48.9%)	41.21-56.52		
Fat	41	9(22%)	13	4(30.8%)	54	13 (24.1%)	13.48-37.64		
Total	240	136 (56.7%)	144	76 (52.8%)	384	212(55.2%)	50.08-60.25	45.755	0.000

Table.7 Types of lungworm infections detected in Sheep and Goats during postmortem examination

Types of infection	Species			
	Sheep (N= 240)	Goat (N =144)	Both species(N=384)	
	No. positives (%)	No. positives (%)	No. positives (%)	95% CI
Dictyocaulus filarial	64(26.6%)	24(16.6%)	88(22.9%)	18.80-27.45
Mullerius capillaries	42(18%)	30(20.8%)	72(18.7%)	14.96-23.01
Protostrongylus rufescens	17(7.1%)	18(12.5%)	35(9.1%)	6.43-12.44
Mixed				
Df + Mc	8(3.30%)	1(0.7%)	9(2.3%)	1.07-4.40
Pr + Mc	2(0.83%)	1(0.7%)	3(0.9%)	0.16-2.26
Df +Pr	3(1.30%)	2(14.3%)	5(1.3%)	0.42-3.01
Total	136(56.7%)	76(52.8%)	212(55.2%)	50.08-60.25

The result of this study was in line with Dawit (2012) in Jimma abattoir, Nuraddis and Yared (2012) at Mekelle town also reported *D. filaria* .

Table.8 Lung worm species burden of sheep and goat slaughtered at Yirgalem municipal abattoir

Lungworm species	No. of worms	No. affected lung	Mean ± SEM
Dictyocaulus filarial	1893	88(41.5%)	21.51 ± 1.266
Mullrius capillaries	640	72(34.0%)	8.89 ± 1.021
Protostrongylus rufescens	223	35(16.5%)	6.37 ± 1.253
Mixed infection	206	17(8.0%)	12.12 ± 1.682
Total	2875	212(100%)	13.56 ±0 .814

burden was highest and lowest was in *M. capillaries* and *P. rufescens*, respectively. The present result and Sefinew *et al*. (2006) agreed with the type of lung worm with the lowest mean worm burden, *P. rufescens*. But, differ with the highest worm burden. In the present study the highest mean worm burden was *D. filaria* (21.51 ± 1.266) and that of Sefinew *et al.* (2006) was *Mullrius capillaries* (49.7).The variation in mean worm burden might be due to the unfavorable condition for the intermediate host of *Protostrongylus rufescens* in Dale district and the presence of direct life cycle in *D. filarial*, which did not need intimidate host. Moreover, the present study was conducted in short rainy season which was more favorable for *D. filarial* reproduction while Sefinenw *et al.* (2006) season of study was November to march.

The result of this study showed that the predominant lungworm species of both faecal and postmortem examination was *D. filaria.* The overall prevalence of lugworm infection confirmed by the present study was 52.5% and 60.8% in postmortem and faecal examination, respectively. The variation might be due to fattening and deworming of slaughtered sheep and goats they sell these animals for

house hold expense and farmers give more attention to males than females by feeding good nutrition for increasing the income of money. Fattened animals and animals' feed good nutrition perform well and have good immunological status compared to the one which have no supplements as in the case of those sampled from Peasant association for faecal examination.

The result of the present study showed that lungworm infection is problem of both sheep and
Goats in Dale district. The predominant species of feacal and postmortem examination in the study area were D. *filaria* although high mixed infections were also observed. Younger sheep and goats were found to be more affected by the infection of lungworms than adults. The prevalence of lungworm infection was higher in those sheep and goats with very thin and thin body conditions than in those with average or fat body conditions. The result of this study indicated that the high numbers of lungworm infection in the study area indicates that there were conducive conditions for larval development on grazing pasture and the intermediate hosts of lungworm. Therefore, education and awareness creation of farmers about the biology of lung worms, its transmission, sign and symptoms, choosing the best parasitic control strategy and grazing management system of small ruminants should be practiced.

Acknowledgement

The authors would like to thanks the Yirgalem Dale Woreda Agricultural office and Yirgalem municipal abattoir for devoting their precious time in providing the required information and samples through the designed Dale district (PAs) areas where sheep and goats are managed by farmers in the study area.

References

Anne, M. Z. and A.C. Gray, 2006. Veterinary clinical parasitology. 7 ed. Australia, Blackwell publishing, pp: 11-14.

Armour, J., 1980.The Epidemiology of Helminth Disease in Farm Animals. *Veterinary Parasitology* 6: 7-46.

Cabaret, J., Antoine, T. 2008. http://wcentre.tours.inra.fr/sfpar/stat.htm.Col es, G.C., 2002. Cattle nematodes resistant to anthelmintics: Vet. Res. 33 481-189

CSA, 2011. Population and Housing Census of Ethiopia: Results for Southern Nations, Nationalities and Peoples' Region, Vol. 1, part 1

Dawit W. 2012. Prevalence of Small Ruminant Lung Worm Infection in Jimma Town.DVM Thesis, Jimma University *College of Agriculture and Veterinary Medicine* pp 1-7.

Fraser, C. M., 1991. The Veterinary Manual. A Hand Book of Diagnosis,Therapy and Disease Prevention and Control for Veterinary,7th ed. Morck and co.incrahway.NIT USA pp714-717.

Gatentby, R. M., 1991. Sheep: The tropical agriculturalist. London and Basingstoke, education Ltd, ACCT. pp. 6-10.

Gorski, P., Niznikowski, R., Popielarczyk, D., E., Strzelec ,2004. Natural parasitic infections in various breeds of sheep in Poland. *Arch. Tierz. Dummerstorf.*, 47: 50-55.

Kahn, Cynthia (Ed). 2005. The Merck Veterinary Manual.Ninth Ed. Merck and co.,INC., white house station ,U.S.A .pp.215-256.

Mezgebu M, 1995. A survey on ovine *fascioliasis* and lungworm infection in Addis Ababa and the surrounding highland areas. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre-Zeit, Ethiopia

Mihreteab B and Aman A, 2011. Ovine

Lungworms in Tiyo District, South-East Ethiopia: Prevalence, Effect of Altitude and Major Host Related Risk Factors. *Global Veterinaria* **7** (3): 219-225

Nemat, E.A. and G. A. Moghadam, 2010. A Survey on Annual Infestation of Sheep with Lung Worms based on Fecal Test and Slaughter House Study in Tabriz. Journal of Veterinary Research, 64: 339-342.

Netsanet B, 1992. Study on the Prevalence and Control of Lung Worms (Dictycaulus and Meullerius) in local Ethiopian Highland sheep in and around Debre Birhan. DVM Thesis, Addis Ababa University, Debrezeit, Ethiopia.

Nuraddis I, and Yared D,2012. Prevalence of Ovine Lung Worm Infection in Mekelle Town, orth Ethiopia. *The Internet Journal of Veterinary Medicine*. 2012 Volume 9 Issue 1

Pugh. D. G., 2002. Sheep and Goat Medicine. Saunders Elsevier, USA.pp.123-124.

Radostitis, O. M., C. C. Gay and K.W. Hinchcriff, 2007. Veterinary Medicine: A text book of the disease of cattle, horses, sheep, pigs and goats. Saunders Elsevier, USA pp.1576-1579.

Rehbein, S., VISSER, M. and, R., Winter , 1998. Endoparasitic infections in sheep from the Swabian Alb. *Dtsch. Tierarztl. Wochanschr*., 105: 419-424.

Regassa, F., Molla,A., Bekele, J., 2010. Study on the prevalence of cystic hydatidosis and its economic significance in cattle slaughtered at Hawassa Municipal abattoir, Ethiopia. *Trop. Anim. Health. Prod*., 42, 977-984.

SEDPSZ (Socio-economic and demographic profile of Sidama zone), 2004. Finance and economic development coordination department. SEDPSZ, Awassa, Ethiopia.

Sefinew A, Esayas G, L , Gelagay A, and Aschalew Z, 2006. Study on Small Ruminant Lungworms in Northeastern Ethiopia. *Veterinary parasitology*. pp6.

Sissay A, 1996. Preliminary Study on the Prevalence of Ovine Lungworm Infection in and Around Bahir Dar. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre-Zeit, Ethiopia.

SNNPRS–RSA, 2011. Southern Nations, Nationalities and People's Regional State–Regional Statistical Abstract, 2011/12. Bureau of Finance and Economic Development Division of Statistics and Population. Awassa, Ethiopia.

Soulsby E. J. L, 1982. Helminths, Arthropods and Protozoa of Domesticated Animals, Seventh Edition. Bailliere Tindall, London: Lea and Febiger, Philadelphia; Pp. 212-258.

Tarazona, J.M., 1984. *Lungworm infections in goats and sheep in Spanish conditions*. Les Maladies de la Chevre. pp. 353-355.

Thrusfield, M., 2007. Veterinary epidemiology. 3rd ed. UK Blackwell science pp-610

Torney, P.M., 1989. Manual of Tropical Veterinary Parasitology. Heliminthes of Livestock and Poultry in Tropical Africa. The International Technical Center for Agriculture and Rural Co Operation, CAB. International .pp 81-85.

Uqbazghi, K., 1990. Preliminary survey on the prevalence of lungworm in small ruminants Hamassin Awraja. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre-Zeit, Ethiopia, pp: 58.

Urquhart G. M, J. Aremour J. L. Dunchan A M. Dunn and F. W. Jeninis, 1996: Veterinary parasitology 2nded. The University of Glasgow, Blackwell sciences, Scotland; pp1-10

Wamae. L. W., and M. A. K. Ihiga, 1991. *Bulletin of Animal Health and Production in Africa*, 39:257-269.

Wilsmore,T., 2006. Disease of Small Ruminants in Ethiopia. The Veterinary Epidemiology and Economics Research Unit of Agricultures Policy and Development the University Of Read, UK. Pp: 602.