

Large Intestinal Nematodes of Small Ruminants Slaughtered in Elfora Export Abattoir, Bishoftu, Central Ethiopia

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Abstract: A cross-sectional study was carried out to identify the species and worm burden of large intestinal nematodes of small ruminants slaughtered at ELFORA export abattoir, Bishoftu from November 2016 to April 2017. During the study period a total of 140 small ruminants (67 sheep and 73 goats) large intestines were examined for intestinal nematodes, following the standard procedures. The current study revealed overall prevalence of 105 (75%) large intestinal nematode in small ruminants. Two species of intestinal nematodes (*Oesophagostomum columbianum* and *Trichuris ovis*) were identified in both sheep and goats intestine with an overall prevalence of 79.1% and 71.23% respectively. The specific prevalence observed was *O. columbianum* (71.64%) and *T. ovis* (43.3%) in sheep and *O. Columbianum* (64.4%) and *T. ovis* (35.6%) in goats were recorded. Among considered risk factors in relation to the prevalence of intestinal nematodes body condition and age had statistically significant difference ($p < 0.05$). The mean adult worm counts of *O. Columbianum* and *T. ovis* were 82.24 and 21.04 in sheep and 64.25 and 13.56 in goats respectively. There was no significant difference ($P > 0.05$) in the mean adult worm counts of large intestinal nematodes between species, ages body condition and origins of animals. In general, a high infection rate with large intestinal nematodes was observed in both sheep and goats during the study period. Therefore emphasis should be given for the control and prevention of large intestinal nematode infection with further studies on species identification and burden of the parasites.

Key words: Large Intestine • Nematodes • *O. columbianum* • Small ruminants • *T. ovis*

INTRODUCTION

Livestock systems in developing countries are characterized by rapid change, driven by factors such as population growth, increases in the demand for livestock products as incomes rise and urbanization. Livestock currently contribute about 30 percent of agricultural gross domestic product in developing countries [1] and is becoming the fastest growing sub-sector of agriculture [2]. Africa hosts 205 and 174 million sheep and goats representing 17% and 13% of the world total small ruminant population, respectively. The population of small ruminants in sub-Saharan Africa is estimated to be 274 million [3].

Ethiopia has the largest livestock production in Africa, estimated at 56.71 million cattle, 29.33 million sheep and 29.11 million goats respectively [4]. Among this livestock population, small ruminant constitute a major

part and important source of income for agricultural community and are one of Ethiopia's major sources of foreign currency through exportation of live animals, meat and skin [5, 6].

Even though, the livestock sub sector contributes much to the national economy, its development is hampered by different constraints. Among these constraints, gastrointestinal parasite infections are the major ones. Helminthosis of sheep and goat is among the endoparasite infections that are responsible for economic losses through reduced productivity and increased mortality [7]. The loss through reduced productivity is related to reduction of food intake, stunted growth, reduced work capacity, cost of treatment and control of helminthosis [8, 9, 10]. The effect of infestation by gastrointestinal helminths varies according to the parasite concerned, the degree of infestation and other risk factors such as species, age, season and intensity of worm burden [11].

Parasitological investigations carried out in different regions of the country have demonstrated the existence of a wide range of GI nematodes which belong to the genera of *Haemonchus*, *Trichostrongylus*, *Oesophagostomum*, *Bunostomum*, *Strongyloides*, *Cooperia*, *Bunostomum*, *Nematodirus* and *Trichuris species* [12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22].

But most of these previous studies performed were based on coprological examinations which are less sensitive in identifying the nematode species. However some Studies were conducted based on postmortem examination for identification of the nematode species which were limited to identifying abomasal nematodes [12, 23, 15, 24, 25] and small intestine nematodes [12, 24, 26].

However, explored literature reviews showed scarcity of published papers on the study of LI nematodes based on post mortem examination even though these parasite infections result in high economic losses in small ruminant production system. Therefore, the objectives of this study were to identify species, determine level of parasitism and associated risk factors of large intestine nematodes of small ruminants slaughtered at ELFORA Export Abattoir.

MATERIALS AND METHODS

Study Area: The study was conducted from November, 2016 to March, 2017 in ELFORA export abattoir in Bishoftu, Oromia region, Ethiopia. Bishoftu has an altitude of 1850 meter above sea level and experiences a bimodal rainfall pattern with a long rainy season from June to October and a short rainy season from March to May. The average annual rainfall and averages maximum and minimum temperature of the area are 800mm, 260C and 140C, respectively. The geographical (astronomical) location of Bishoftu town is approximately located at 8° 44' N latitude and 38° 57' E longitudes, 47 km South East of Addis Ababa at an altitude of 1950 meter above sea level [4].

Study Animals: The study animals were a male Sheep's and Goat's presented to the ELFORA export abattoir from different parts of the country including Arbaminch, Somali, Borena and Jinka for slaughter. The studied animals were small ruminants of local breed with different age, origin and body condition those were brought to slaughter. The origins of animals were recorded from the animals merchants that provide animals for the abattoir. In this study a total of 140 small ruminants (N=67 sheep

and N=73 goats) destined for slaughter were examined and they were grouped into young and adults. Age categorization into young and adult was performed. Accordingly those sheep <1.25 year and goats under 1 year were categorized as young and adults are above one year for goats and above 1.25 year for sheep. Body condition scoring was also carried out based on the handbook given by Ethiopian Sheep and Goat Productivity Improvement Program (ESGPIP) as it is indicated on [27].

Study Design and Sampling Method: A cross-sectional study was conducted to identify the species and determine level of parasitism of LI nematodes of small ruminants slaughtered at ELFORA export Abattoir. During the study periods, 140 animals belonging to a group of young and adults were randomly sampled using systematic random sampling method. Before the animals were slaughtered ante-mortem examination was conducted to record animal's species, body condition, age and origin of animals.

Study Methodology

Sample Collection: Large intestine was removed from the abdominal cavity of animals and ligated at both ends and immediately taken out and washed to the sample container. The collected sample was transported to Veterinary parasitology laboratory of Faculty of Veterinary Medicine, Addis Ababa University for appropriate examinations.

Large Intestine Worms Recovery, Identification and

Count: Two to three days per week to collect samples from ELFORA export abattoir was made and samples were brought to the Faculty of Veterinary Medicine, veterinary parasitology laboratory for further identification of the parasites. Recovery, count and identification of LI parasites were made using procedure described in [28, 29]. Large intestine was opened and its contents were washed in to a bucket up to a total volume of 2 liters from which an aliquot of 200ml was transferred to labeled graduated bottles. A sub sample of 20 ml was taken in to a Petri dish for examination of large intestine worms under stereomicroscope and species identification of the Helminthes was examined under compound microscope ($\times 10$) power. The identification of worm was according to [30]. For those positive large intestinal samples, the numbers of worms were determined by multiplying 20 ml (aliquot) $\times 100$ (factor) as described by [28].

Data Analysis: The data was entered and managed in MS excel sheet and analyzed by using SPSS version 20. Descriptive statistics were used to determine the prevalence of the parasites and Chi-square test (χ^2) was used to measure statistical significance of the result. In all the analyses, confidence level was held at 95% and P-value less than 0.05 were considered as significant.

RESULTS

Prevalence and Associated Risk Factors: In this study a total of 140 small ruminants were examined using postmortem examination for LI nematodes identification and determine level of infestation. Out of the 140 small ruminants (67 sheep and 73 goats) examined, 105 (n=53 sheep and n=52 goats) were positive for one or more helminthes parasite with the overall prevalence of 75%. The species of nematodes recovered from large intestine of both sheep and goats at post mortem examinations were *Oesophagostomum columbianum* and *Trichuris ovis*. The overall prevalence of *O. columbianum* and *T. ovis* in small ruminants were 67.85% and 39.28% respectively (Table 1).

From a total number of studied animals during the study period, 44 (31.4%) animals were infected with both species of parasites, 51(36.4%) animals were infected with *O. Columbianum* and the rest 10(7.1%) of animals were infected with *T.ovis* only (Fig. 1).

From a total of 67 sheep examined 53 (79.1%) were positive for one or both species of helminthes parasites. Forty eight (71.64%) of the sheep were infected by *O. Columbianum* while 29(43.28%) were positive for *T.ovis* (Table 1). Twenty three (34.33%) sheep were found infected with both parasites identified, while 25(37.31%) and 6 (8.95%) were found infected with *O. Columbianum* and *T. ovis*. respectively.

Out of 73 goats large intestines examined 52(71.2%) were positive for one or both helminthes parasites. From these, 47 (64.4%) were affected by *O. Columbianum* and 26(35.6) were positive for *T.ovis* (Table 3). Twenty one (28.76%) goats were infected with both species of parasites identified, while 26 (35.61 %) and 5(7.2%) were harboring *O. Columbianum* and *T.ovis* respectively. There was no significant difference in prevalence of LI intestinal helminthes between the two species of hosts ($P > 0.05$).

An attempt was also made to relate the impact of other risk factors rather than species to determine the prevalence of the LI nematodes. Prevalence of 82.9% and 63.8% of LI nematodes were recorded in young and adult small ruminants, respectively which did have statistical significant difference ($P < 0.05$). While the prevalence of

individual parasites species identified during study period in young and adult animals was 76.8% and 55.2% for *O. Columbianum* and 47.6% and 27.6% for *T.ovis* respectively. There was statistical significant difference for both *O. Columbianum* ($p < 0.05$) and *T. ovis* ($p < 0.05$) in both age groups.

Animals examined for infection of LI nematodes are originate from four different localities; Borena, Jinka, Somali and Arba Minch. The occurrences of these LI nematodes infection were highest in animals originating from Somali (87.5%) and lowest in animals originating from Jinka (64.9%). The difference in the prevalence of infection among the origin of animals were not statistically significant ($p > 0.05$).

Parasite Burden and Intensity: The overall mean of LI nematode count was 51.64 in sheep and 38.9 in goats. The mean count of *O. Columbianum* and *T.ovis* in sheep and goats were 82.24 and 21.04 and 64.25 and 13.56 respectively. There was no significant difference ($p > 0.05$) in the burden of parasites among the two hosts for both parasites identified (Table 2).

From a total of examined animals, 82 animals were young and 58 animals were adults. In these age groups the mean count of *O. Columbianum*. and *T.ovis* in young and adults were 79.76 and 21.22 and 63.10 and 11.38 respectively. There was no statistical significant difference in the burden of *O. Columbianum* and *T. ovis* in both age groups ($p > 0.05$).

During the study period, the mean worm counts in animals with medium and good body condition was 85.54 and 64.40 *O. Columbianum* and 20.54 and 14.88 *T.ovis* respectively. High mean worm burden of *O. columbianum* was recorded in animals from Arbaminch 91.58 and lowest in animals from Jinka 56.22 while the mean worm burden of *T.ovis* was high in animals from Borena 19.81 and lowest in animals from Jinka 11.62. The mean worm burden counts had no statistical significance difference within both risk factors (body condition and origin) ($p > 0.05$).

From a total examined sheep 28(41.8%), 8(11.9%) and 12(17.9%) were lightly, moderately and heavily infected by *O. Columbianum* respectively while 19(28.4%), 9(13.4%) and 1(1.5%) were lightly moderately and heavily infected by *T.ovis* respectively Similarly from total examined goats 27(37%), 9(12.32%) and 11(15.07%) were lightly, moderatly and heavily infected by *O. Columbianum* respectively while 20(27.4%) and 6(8.2%) were lightly and moderatly infected by *T.ovis*. There was no goat with heavy infection of *T.ovis*. There was no statistical significance difference in degree of infection between two hosts for both species of parasites (Table 3).

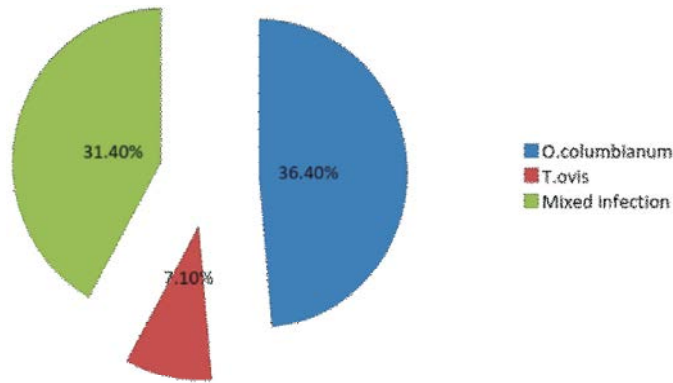


Fig. 1: Infection type of LI nematodes of sheep and goats slaughtered in ELFORA export abattoir, Bishoftu

Table 1: Prevalence of large intestinal helminthes parasites in sheep and goats with different risk factors in ELFORA export abattoir, Bishoftu

Risk factors	Categories	Total No. of animals examined	Number of positive animal for LI nematodes		Number of positive animal for <i>O. columbianum</i>		Number of positive animal for <i>T. ovis</i>	
			Positive	χ^2 (P-value)	Positive	χ^2 (p-value)	Positive	χ^2 (p-value)
Species	Sheep	67	53(79.1%)	1.155(0.283)	48(71.64%)	0.844(0.358)	29(43.3%)	0.861(0.353)
	Goats	73	52(71.23%)		47(64.4%)		26(35.6%)	
Age	Young	82	68(82.9%)	6.633 (0.010) *	63(76.8%)	7.30(0.007) *	39(47.6%)	5.68(0.017) *
	Adult	58	37(63.8%)		32(55.2%)		16(27.6%)	
BCS	Medium	56	49(87.5%)	7.778 (0.005)*	45(80.1%)	6.68(0.010) *	26(46.4%)	1.96(0.158)
	Good	84	56(66.67%)		50(59.5%)		29(34.5%)	
Origin	Borena	52	38(73.1%)	4.954(0.175)	36(69.2%)	5.097(0.165)	21(40.4%)	2.886(0.410)
	Jinka	37	24(64.9%)		20(54.1%)		11(29.7%)	
	Somali	32	28(87.5%)		24(75%)		13(4.6%)	
	Arbaminch	19	15(78.9%)		15(78.9%)		10(52.6%)	
Total	All	140	105(75%)		95(67.85%)		55(39.28%)	

χ^2 = chi-square * indicates statistically significant association (p<0.05)

Table 2: Mean count of adult Large intestinal Nematodes in sheep (n=67) and goats (n=73) slaughtered in ELFORA export abattoir, Bishoftu

Risk factors	Categories	<i>O. columbianum</i>		<i>T. ovis</i>	
		Mean \pm SE	p-value	Value Mean \pm SE	P-value
Species	Sheep	82.24 \pm 11.03	0.191	21.04 \pm 3.54	0.095
	Goats	64.25 \pm 8.325		13.56 \pm 2.761	
Age	Young	79.76 \pm 8.465	0.202	21.22 \pm 3.101	0.490
	Adults	63.10 \pm 11.384		11.38 \pm 3.027	
BCs	Medium	85.54 \pm 10.787	0.090	20.54 \pm 3.688	0.333
	Good	64.40 \pm 8.809		14.88 \pm 2.796	
Origin	Borena	74.62 \pm 13.080	0.206	19.81 \pm 4.041	0.170
	Jinka	56.22 \pm 11.484		11.62 \pm 3.999	
	Somali	78.13 \pm 11.783		19.69 \pm 4.825	
	Arbaminch	91.58 \pm 19.410		16.32 \pm 4.849	

Table 3: Number of sheep and goats under different degree of infection with large intestinal nematodes in ELFORA export abattoir, Bishoftu

Intensity	<i>O. columbianum</i>		χ^2 (p-value)	<i>T. ovis</i>		χ^2 (p-value)
	Sheep	Goat		Sheep	Goats	
Light	28(41.8)	27(37%)	1.669(0.64)	19(28.4)	20(27.4)	2.326(0.508)
Moderate	8(11.9%)	9(12.32%)		9(13.4%)	6(8.2%)	
Heavy	12(17.9)	11(15.07)		1(1.5%)	0(0%)	
Total	48(71.6)	47(64.4%)		29(43.3)	26(35.6)	

DISCUSSION

The present study shown an overall prevalence of LI nematodes in small ruminants was found to be 75%. This finding is similar with reports of [31] who found 74.58% in Asella; [32] reported 70.25% in Kombolcha; [33] result of 74.1%. in Bangladish. On the other hand, some other investigators reported lower prevalence of LI nematodes in small ruminants 61.4% [12] from Eastern part of Ethiopia; 55% by [34] from Illubabor 59.12% by [35] from Mekele and 14.5% by [17] in different parts of the country.

The prevalence between species was 79.1% in sheep and 71.23% in goats. In contrary, several researchers reported lower prevalence in different parts of Ethiopia and the world including 50 and 45%; 3 and 4.1%; 62.87 and 59.49% reports in sheep and goats by Tefera *et al.* [36] Raza *et al.* [37] and Abebe and Esayas, [12], respectively. It is also shown that 55.23% [38] and 9.75% [39] in sheep and 45.59% in goats [40]. The disparity in overall and species level prevalence between researches might be due to the dissimilarity between the sample size determination and examination method and as this research was done by adult parasite recovery through postmortem procedure, unlike most of previous researches conducted via coprological methods, which is more sensitive. Moreover, various managemental and environmental factors such as management system of examined animals, geographical location of the area and level of education as well as economical capacity of the community. A variety of factors that animal attributes and health status with treatment procedures like age, grazing habits, presence or absence of inter-current infections, the standard of management and anthelmintics usage are also play a crucial role for these variations.

In this study higher rate of infection was recorded in young animals (82.9%) than in adult animals (63.8%) with statistical significance ($p < 0.05$). This finding is agreement with other reports [41, 42, 43, 44]. A number of authors have demonstrated an increased prevalence in young age [45]. This higher infection rate in young animals than adult ones might be due to lower immunity of younger sheep compared to adult animals and [44, 46] have documented that adult and old animals develop acquired immunity against helminthes infections as they get mature due to repeated exposure and this will help expel the parasite before it establishes itself in the GIT. However, there are instances where younger animals were reported to be resistant to parasitic infection [47].

The occurrence of infection in animals with different body condition scores showed statistically significant difference ($p < 0.05$) with the highest rate being recorded in those animals with medium (87.5%) body condition followed by those with good (66.67%) body condition shoeing small animals having better body conditions were with less burden. The finding was agreement with [48, 49]. These differences could be ascribed due to differences in the adaptive immunity differences between body conditions. Animals with good body condition can elicit relatively stronger humoral and cell mediate immune responses which can arrest the parasitic development.

The present study identified *O. columbianum* and *T. ovis* from LI of small ruminants. The species of helminthes parasites identified in this study have been reported earlier in Ethiopia [17, 38, 40, 36, 50, 51]. *Oesophagostomum columbianum* was detected in 71.64% and 64.4% of sheep and goats in the study period respectively and this was in agreement with Haillelul [38] who reported prevalence of 74.42% in sheep in and around Wolaita Sodo; Esayas [40] who reported prevalence of 61.13% in Ogaden goats; Abebe and Esayas [12] who stated prevalence of 74.88% in sheep and 70.8% in goats in eastern part of Ethiopia during the dry season of the year. Unlike the present study, lower prevalence of *O. Columbianum* was presented as 43.3% [50] in sheep whereas higher prevalence also reported 89.89 % in sheep by Mazid [33].

The prevalence of *Trichuris ovis* was 43.3% and 35.6% in sheep and goats respectively. This result agrees with [36] who reported 47.8% in sheep and 45% in goats, Haillelul [38] who has stated 36.04% in sheep and 28.57% in goats and Esayas [40] who has reported 36.04% prevalence of *Trichuris* species in goats and Islam [53] reported 42.23 in sheep. Disagreeing with aforementioned studies higher prevalence was reported by Temesgen [54] (3.3%), Diriba and Birhanu [55] (3.7%). On the other hand Mazid [33] reported 58.29% in sheep which is higher than this study.

The mean count of 82.24 and 64.25 adult worms for *O. columbianum* and 21.04 and 13.56 for *T. ovis* in sheep and goats, respectively were recorded in the study. This finding is comparable with the findings of [12] who reported 83.4 and 75.3 in sheep and goats for adult *O. columbianum*. On the other hand, lower mean count of 10.17 for *O. Columbianum* and 7.55 for *T. ovis* in sheep was revealed [33]. This difference might be due to age, body condition and management system of animals as well as geographical location also has its own effects.

The data shows difference between age groups accounting 79.76 and 21.22 and 63.10 and 11.38 for *O. Columbianum* and *T.ovis* in young and adults were recorded, respectively. It was also in line with some previous studies reported low level of helminth infection reported in adult than young groups [56, 57, 58].

The degree of infection of both *O. columbianum* and *T. ovis* infections were dominated by light observed in the present study which is in close agreement with [26, 59, 60] showing that the parasites earns treacherous loss in the productivity of small ruminants in the study area. Even if the intensity was heavier in the majority, it has substantial effect on morbidity and even sometimes mortality considering the study was conducted in the abattoir where animals with poor body conditions were not usually considered for slaughtering.

CONCLUSION

Gastrointestinal nematode parasites are the major animal health constraints in sheep and goat production and contributing loss in productivity and economy. The present study was based on postmortem examination for detection of large intestinal nematodes. During this study the overall prevalence of 75% LI nematodes were recorded, with specific prevalence of 79.1% in sheep and 71.2% in goats. The species of nematodes recovered from large intestine of both sheep and goats at post mortem were *Oesophagostomum columbianum* and *Trichuris ovis*. Among considered risk factor body condition and age of animals had statistically significant difference in relation to the prevalence of intestinal nematodes ($p < 0.05$). The mean worm burden of large intestine nematodes was assessed and the overall mean of LI nematode count was 51.64 in sheep and 38.9 in goats with no statistical significant difference with all considered risk factor ($P > 0.05$). In general the present study indicates high prevalence of LI nematodes with light to heavy degree of infection in small ruminants. Therefore, it is critical to implement different control measures like strategic deworming program of small ruminants should be introduced to counteract high level of parasitism of nematodes. Besides, detailed study should be conducted to estimate the prevalence of large intestine nematodes by post-mortem examination methods, quantify parasite burden and associated risk factors in the study the country.

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