

Abomasal and Small Intestinal Nematods of Small Ruminants Slaughtered in Different Restaurants in Hawassa

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Abstract: Cross-sectional study of nematode parasites of sheep and goats was conducted from November 2008 to May 2009 in Hawassa with an attempt to determine the prevalence rate and worm burden of abomasal and small intestinal nematode of sheep and goats. A total of 180 post mortem examination (112 sheep and 68 goats) slaughtered in different restaurants in Hawassa town were examined. Five species of nematode were identified in both animal species with the overall prevalence rate of 72.3 and 36.8% of small intestinal nematodes in sheep and goats, respectively and 82.1 and 61.8% of abomasal nematode in sheep and goats, respectively. The specific prevalence rates observed for nematode were 75.9, 4.5 and 29.4% in sheep and 55.9, 2.9 and 26.4% in goats of *Haemonchus contortus*, *Trichostrongylus axie* and *Ostertagia (Teladorsagia) circumcincta*, respectively and 63.4 and 29.4% of *T. Columbriformis* in sheep and goats, respectively and 47.3 and 23.5% of *Bunostomum trigonocephalum* in sheep and goats, respectively. There was statistically significant difference ($p < 0.05$) in the prevalence rate of the parasite with age and species of animals while *Trichostrongylus axie* has no significant difference ($p > 0.05$). The present study showed that nematode of sheep and goats are the most prevalent problem in the study area affecting the health of those animals and appropriate control measure should be instituted.

Key words: Hawassa, nematode parasites, post mortem examination, sheep, goats, Ethiopia

INTRODUCTION

About 85% of the population of Ethiopia is farmer whose livelihood depends on agriculture. Live stock production is an important sector of the country's agricultural economy, providing a significant contribution to gross domestic and export products and raw materials for industries. In Ethiopia small ruminants represent an important component of the farming system, providing about 12% of the value of livestock products consumed at the farm level and 48% of the cash income generated but account for only 6.6% of the capital invested on the livestock sector by farmers (Kassahun *et al.*, 1989).

Small ruminant provide 46% of the value of national meat production and 58% of the value of hide and skin production and are an integral part of production system in which they serve various function (Tembely, 1988). 25, 017, 218 sheep and 21, 884, 222 goats are found in Ethiopia. They produce meat. Milk, wool, skin and manure and are amongst others, kept as savings which can be easily be converted in cash if needed. Mutton and goat meat contribute 35% of the total meat consumption in the country (Anonymus, 1995).

Although, small ruminants represent a great resource for the nation, the productivity per animal is low. Small ruminant disease, poor management and lesser effects provided to improve the performance of the animals are to be responsible for the reduced productivity (Ademosum, 1992). In many sub-Saharan African countries including Ethiopia, helminthes adversely affect production and productivity of small ruminants (Boomer *et al.*, 1994).

Although, helminthes parasites of small ruminants are ubiquitous in all of the agro-climatic zones of Ethiopia, with prevailing weather conditions that provided favorable condition for their survival and development, their presence does not mean that they cause overt disease therefore it is important to assess the types and level of parasite in small ruminant in order to be able to determine the significance of parasite infections and to recommended the most beneficial and economically acceptable control measures.

Although, the causes of helminthes parasitism in small ruminant are multiple and often interactive, the vast majority of causes are due to an increase in the number of infective stages on pasture an alternation in host susceptibility, the introduction of infections in to an

environment and ineffective parasitic removal from the host animals due to poor administration techniques, the use of sub-standard anthelmintic drugs or the development of anthelmintic resistance (Urquhart *et al.*, 1996). Sheep and goat are usually infected with a range of different species of nematodes. The economically most important and widely prevalent gastro-intestinal tract nematodes are the Tricoststrongyloidea that include genera such as *Haemonchus*, *Tricoststrongylus*, *Cooperia*, *Nematodirus* and the *Strongyloidea* and *Ancylostomatoidea* with *Osophagostomum* and *Bunostomum*, respectively (Graber, 1978).

The control of nematode parasite of livestock in Ethiopia is based on the use of antihelmintics. Pasture management is either unknown or not practiced by peasant farmers of small holders. Due to high cost of drugs peasant farmers do not deworm regularly but rather treat selectively according to clinical signs (Tembely *et al.*, 1997). Due to this underlined fact there is high prevalence of the disease. Therefore this study was undertaken with the objectives to determine the prevalence of abomasal and small intestinal nematodes in small ruminant slaughtered in Hawassa town to determine the relationship between the risk factors like age and species and the prevalence and to look the burden (intensity) of abomasal and small intestinal nematodes in small ruminant, slaughtered in Hawassa town.

MATERIALS AND METHODS

Study area: The study was conducted in Hawassa. Hawassa is the capital city of Sidama zone and SNNPR region which is located in the northern part of SNNPR 275 km South of Addis Ababa. It geographically lies between 4°27' and 8°30' latitude N and 34°21' and 39°1' Longitude. The area receives 800-1000 mm rain fall in average annually. During the study period the mean minimum and maximum temperature of the area was 20.1 and 30°C, respectively and mean relative humidity was 51.8%. Hawassa lies at an altitude of 1790 m.a.s.l. The area mainly covered by dry savanna and bush type of vegetation.

Study animals and sampling method: The study was conducted on sheep and goats slaughtered in different restaurants in Hawassa town. A total of 112 sheep and 68 goats of abomasums and small intestines were examined. As most of them were obtained from different markets it was difficult to trace the exact origin of the animals. During study examination of the teeth it was estimated that the age of the animal range from 2-5 years according to Steel (1996) and Gatenby (1991).

In order to undertake the postmortem examination, the abomasums were ligated with string and separated from omasum and duodenum and the small intestine was ligated at both ends to avoid leakage and separated from the stomach and large intestine. Both organs were collected as soon as possible, usually within 30 min of evisceration and transported to the laboratory immediately for examination with plastic bag. Worm collection, identification and counting were made in accordance with procedures and techniques described by Hansen and Perry (1994).

Study design and sample size: The type of study was cross-sectional. The sample size was calculated according to the formula given by Thrusfield (2005) by using 95% level of confidence and expected prevalence was 85.65% from previous study and desired absolute precision 5% and finally 180 sheep and goats are included as sample size and simple random sampling strategy was used to select individual animal.

Worm recovery: The laboratory work was done at parasitology laboratory of Department of Animal science, Hawassa College of Agriculture, Hawassa University. The abomasums and intestines were taken from different restaurants and after the arrival in the laboratory they were opened and examined for adult parasitic worm according to standard procedure described by Hansen and Perry (1994).

The intestine and abomasums were placed on a clean tray, separated the intestine from the mesentery and washed in a clean small plastic bucket pre-labeled at 2 L by pouring water at one end. The intestine was then opened on the tray with the help of a gut-runner. It was then washed and scraped in the bucket to recover smaller parasites and also the abomasum was opened along the greater curvature then washed. The empty abomasum thoroughly washed in the tray several times, paying particular attention to cleaning between the folds of the mucous membrane. Finally the total volume of contents and washings in the bucket was made 2 L by pouring additional water. The total content was stirred vigorously until all food material, mucous and water were mixed. 200 mL of the contents were transferred to wash jar in 5 steps of 40 mL per step. Stirring the mixture continuously then fill the wash jar with water and invert the jar and shake it till most of the fluid is shaken out and add water until clear fluid comes out. The 20 mL of the washed content were poured into Petri dishes and a few drops of iodine solution were added and mixed with the sample and allowed to stand for 35 min to stain the worms.

Finally the samples were examined for the presence of nematodes which were collected and preserved in 10% formalin for further identification and counting and examined under stereo microscope. Then, the number of parasites found in 20 mL times 100 gave the total number of parasite found in the abomasums and intestine (Hansen and Perry, 1994).

Species identification: The worms which were preserved in 10% formalin were poured in to Petri dishes and examined under a stereomicroscope. Identification was made using keys developed by various researchers (Hansen and Perry, 1994; MAFF, 1986).

Data management and analysis: All the data that were collected (age, species and parasitic infestation) entered to MS excel sheet and analyzed by using SPSS version 16. Descriptive statistics was used to determine the prevalence of the disease and χ^2 -test was used to look the significant difference between age and species of the host with parasites.

RESULTS AND DISCUSSION

The study found out that the overall prevalence of small intestinal nematode 72.3 and 36.8% of sheep and goats, respectively and 82.1 and 61.8% of abomasal nematode of sheep and goats, respectively. From 112 sheep examined for intestinal parasites 82 (73.22%) were infected with at least one species of nematode parasite and 41 (50%) were infected with two species. The 71 (63.4%) were infected with *Trichostrongylus columbriformis* and 53 (47.3%) were harboring *Bunostomum trigonocephalum*.

About 88 (78.6%) were infected at least with one species and 31 (35.3%) were infected with two species of abomasal nematode. About 85 (75.9%) of sheep were positive for *Haemonchus contortus*, while 33 (29.4%) were having *Teladorsagia circumcincta* and 5 (4.5%) had *Trichostrongylus axie* (Table 1). Out of a total of 68 goats examined for intestinal parasites 11 (44%) were infected with two species while 25 (36.8%) goats were harboring one species of intestinal parasite. About 20 (29.4%) were infected with *T. columbriformis* and 16 (23.5%) were positive for *B. trigonocephalum*. The 45 (66.2%) of goats were infected with at least with one species of abomasal nematode and 13 (28.8%) were harboring two species of parasite. The 38 (55.9%) of goat were positive for *H. contortus* while 18 (26.4%) had *T. circumcincta* and 2 (2.9%) were positive for *T. axie*. There was significant difference of parasitism in the intestine between sheep and goat ($p < 0.05$) (Table 1).

Table 1: Prevalence of adult small intestinal and abomasal Nematode in sheep and goat in Hawassa

Parasites	Sheep (N = 112)	Goat (N = 68)	Total (N = 180)	χ^2 (p-value)
	positive (%)	positive (%)	positive (%)	
<i>T. columbriformis</i>	71 (63.4)	20 (29.4)	91 (46.4)	19.545 (0.00)
<i>B. trigonocephalum</i>	53 (47.3)	16 (23.5)	69 (35.4)	
<i>H. contortus</i>	85 (75.9)	38 (55.9)	123 (68.3)	7.830 (0.005)
<i>T. axie</i>	5 (4.5)	2 (2.9)	7 (3.9)	
<i>T. circumcincta</i>	33 (29.4)	18 (26.4)	51 (27.9)	

Table 2: Prevalence of sheep and goat nematode on age base

Species of parasite	Age in year		χ^2 (p-value)
	2-3 year (%)	>3 year (%)	
<i>H. contortus</i>	82.2	50.6	20.385 (0.000)
<i>T. axie</i>	5.0	2.5	0.694 (0.405)
<i>T. circumcincta</i>	35.6	18.9	10.773 (0.003)
<i>B. trigonocephalum</i>	44.6	30.4	3.768 (0.050)
<i>T. columbriformis</i>	59.4	39.2	7.211 (0.007)

Age can affect the occurrence of parasites. However, there was significant difference ($p < 0.05$) between age and *H. contortus*, *T. circumcincta*, *B. trigonocephalum* and *T. columbriformis* while, *T. axie* has no significant difference ($p > 0.05$) (Table 2). Out of 112 small intestinal samples of sheep examined for adult parasitic worm burden, 71 (63.4) had *T. columbriformis* with a mean count of 7.23 per animal and 53 (47.3) had contain *B. trigonocephalum* with a mean count of 1.74 worms per animal. The 41 (36.6%) sheep did not carry *T. columbriformis*, 55 (49.1%) lightly and 16 (14.3%) were moderately infected. There was no sheep with lightly infected with *B. trigonocephalum* while 53 (47.3%) were moderately infected and 59 (52.7%) sheep were negative. Out of 68 small intestine samples of goat examined for adult parasitic worm burden, 20 (29.4%) goat harbored adult worms of *T. columbriformis* with mean count of 8.35 per animal and 16 (23.5%) had *B. trigonocephalum* with mean count of 2.13 per animal. The 18 (26.46%) of goat were lightly infected and 2 (2.94%) were moderately infected with *T. columbriformis*. 48 (70.6%) of goat did not carry *T. columbriformis*.

There was no goat with lightly infected with *B. trigonocephalum* and 16 (23.5%) were moderately infected while 52 (76.5%) were negative (Table 3). About 85 abomasal samples of sheep had *H. cotortous* with mean count of 5.5 per animal and 5 sheep harboring *T. axie* with mean count of 1.43 worms per animal (Table 4). About 38 goats had *H. cotortous* with mean count of 4.4 adult worms per animal. Two goats contain *T. axie* with a mean count of 1.5 per animal (Table 4). This study indicated significance difference ($p < 0.05$) between species group (i.e., sheep and goat) in *H. contortus*, *T. coubriformis* and *B. trigonocphalum* (Table 1). The higher prevalence was recorded in sheep than in goats. This is agreement with report from different

Table 3: Number of sheep and goat with different level of intensity of infection with small intestinal parasites

Intensity	Sheep (n = 112)		Goat (n = 68)	
	<i>Tricostrolylus columbriformis</i>	<i>Bunostomum trigonocephalum</i>	<i>Tricostrolylus columbriformis</i>	<i>Bunostomum trigonocephalum</i>
Light	55	0	18	0
Moderate	16	53	2	16
Negative	41	59	48	52

Table 4: Number of sheep and goat with different level of intensity of infection with abomasal parasites

Intensity	Sheep (n = 112)		Goat (n = 68)	
	<i>Tricostrolylus axie</i>	<i>Hemochus contortous</i>	<i>Tricostrolylus axie</i>	<i>Hemochus contortous</i>
Light	5 (4.5%)	30 (26.8%)	2 (2.9%)	18 (26.5%)
Moderate	0 (0.0%)	55 (49.1%)	0 (0.0%)	20 (29.4%)
Negative	107 (95.5%)	27 (24.1%)	66 (97.1%)	30 (44.1%)

parts of Ethiopia (Teklye, 1991; Mohammed, 2008) and Kenya (Waruiru *et al.*, 2005). Higher prevalence rate was more common in sheep than in goats due to the grazing habit of sheep.

A significant difference ($p < 0.05$) was observed in prevalence of the parasite on different age groups except *T. axie* ($p > 0.05$). Sheep and goats on the age of 2-3 years had high prevalence than those with age > 3 years (Table 2). The study found that the prevalence decreased as the age increased. This is in agreement with the research done by Urquhart *et al.* (1998). Even though the reasons underlying age resistance are not well known, the possible explanation of this may be the development of acquired immunity and immune-competence increase as the age increases due to high rate of exposure to parasitic infestations (Urquhart *et al.*, 1998). Asanji and Williams (1987) stated that young animals are highly susceptible due to immunological immaturity and immunological unresponsiveness.

Infection of sheep and goat by *Haemonchus* with prevalence of 75.9 and 55.9%, respectively is conducted to be important as a disease of small ruminants in the study area. *Haemonchus* is a voracious blood-sucking parasite and undoubtedly have an impact on the health and productivity of these animals. The prevalence of this parasite is inline with the findings which have been reported in other regions of the country by Tesfalem (1992) reported a prevalence of 59.21% in Bale, Bayou (1992) 58.0% in Buno province of Illubabor, Yosef (1993) 63.0% in Assela, Achenef (1997) 62.87% in Debre Berhan, Haileleul (2002) 58.19% (61.63% in sheep and 54.76% in goat) in Debre Ziet.

The study also found that the prevalence of *Tricostrolylus* species was also considerable in both animal species. Prevalence of *T. axie* was 3.9% (4.5% in sheep and 2.9% in goat) and *T. coumbriformis* was 46.4% (63.4% in sheep and 29.4% in goat). This finding agrees with the researches of Yosef (1993) who found 54.76% in Assela, Haileleul (2002) found 21.43% in Debre Ziet in goats. However, higher prevalence rates were

reported from Addis Ababa 89% by Bekele *et al.* (1982), Kombolcha 83.87% by Genene (1994) and DebreBerhan 62.87% by Achenef (1997). This difference could be attributed to management and environmental factors.

The prevalence rate of *Bunostomum* was 35.4% (47.3% in sheep and 23.5% in goats). This findings agree with reports by Gebreyesus (1986) 34.09% in Gonder, Haileleul (2002) 38.7% (41.86% in sheep and 35.71% in goat) in Debre Ziet, Gebrehiwoit (2008) 46% (50.8% in sheep and 38.0% in goat) in Hawassa, 34% also reported in Hawassa by Biffa *et al.* (2007), Yosef (1993) 40.48% in Assela and Genene 40.7% in kombolcha.

The prevalence of *Ostertagia (Teladorsagia)* species was 29.4 and 26.4% in sheep and goats, respectively. This result is relatively agreed with the research of Geremew (2008) who reported a prevalence of 26.1 and 25.0% in sheep and goats, respectively in Beddelle and Amenu (2005) who reported a prevalence of 15.6% in sheep and goats of three different agro ecological zones of southern Ethiopia.

CONCLUSION

Nematodiosis is one of the major obstacles to live stock productivity in Ethiopia. Its occurrence is mainly associated with the poor management system, lack of disease resistance breed selection and development of drug resistance of the parasite. Observation on the present study conducted on sheep and goats of abomasal and intestinal nematodes for seven months in Hawassa sheeps and goats slaughtered in different restaurants showed that nematode of sheep and goats is the most prevalent disease in the area affecting the health of the animals. In both species of animals examined, the species of parasites identified were the same for abomasums and small intestine. The parasites identified were *T. columbriformis* and *B.trigonocephalum* for small intestine and *H. contortous*, *T. circumcincta* and *T. axie* for abomasums. Species and age were considered as possible risk factors included in the present study. There

was significant difference on age and species. The study indicated that sheep were highly infected than goats. This may be due to the grazing habit of sheep in addition to this 2-3 years animals were highly affected than >3 years this may be due to immunological immaturity and most of the animals in the study area are affected with light to moderate degree of infestation.

RECOMMENDATIONS

Based on the above conclusive remarks the following recommendations were forwarded:

- Education and awareness creation of farmers with regards of epidemiology of parasitic diseases and choosing of the best parasitic control strategy and possible management systems should be given through strong extension
- Use of alternate grazing system for different host species and integrated rotational grazing practices, adjustment of stocking rate and separation of animals according to their age group should be practiced
- Strategic deworming of animals, when conditions are favorable for larval development on the pasture (at the beginning and after rainy season) using broad-spectrum antihelmentics, since polyparasitism is a common problem
- Studies should be conducted to determine the economic losses associated with nematode infections in sheep and goat

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REFERENCES

- Achenef, B., 1997. Observation of ovine gastrointestinal nematodiasis and ceonuroses in sheep population on Ethiopia highland, Debre Berhan, North Showa. DVM Thesis, AAU, FVM, Debre Ziet, Ethiopia.
- Ademosum, A.A., 1992. Constraints and prospects for small ruminants research and development in Africa. *Small Ruminant Dev. Afr.*, 6: 1-5.
- Amenu, A., 2005. Epidemiology of gastrointestinal tract nematodes of small ruminants in three different agro ecological zones of Southern Ethiopia. DVM Thesis, FVM, AAU, Debre-Ziet, Ethiopia.
- Anonymus, 1995. Livestock sector development project. Ministry of Agriculture, Addis Ababa, Ethiopia, pp: 290.
- Asanji, M.F. and M.O. Williams, 1987. Variables affecting the population dynamics of gastrointestinal helminth parasites of small ruminants in Sierra Leon. *Bull. Anim. Health Prod. Afr.*, 35: 308-313.
- Bayou, A., 1992. Prevalence of gastrointestinal helminthes in small ruminants in Buno province of Illubabur. DVM Thesis, AAU, FVM, Debre Ziet, Ethiopia.
- Bekele, M., T. Shibru and G. Feseha, 1982. Survey of gastrointestinal helminthes in small ruminants slaughtered at Addis Ababa abattoir, Ethiopia. *Ethiopian J. Agric. Sci.*, 4: 23-23.
- Biffa, D., Y. Jobre and H. Chaka, 2007. Ovine helminthiasis, a major health constraint to productivity of sheep in Ethiopia. *Anim. Health Res. Rev.*, 7: 107-118.
- Boomer, J., I.G. Horak and K.A. Ramsay, 1994. Helminthes and arthropod parasite of indigenous goat in the northern Transvaal. *Onderstepoort J. Vet. Res.*, 61: 13-20.
- Gatenby, R.M., 1991. *Sheep: The Tropical Agriculturalist*. Macmillan Education Ltd., London, Basingstoke.
- Gebrehiwoit, G., 2008. The prevalence of small intestinal helminthes of small ruminant Slaughtered in different restaurant in Hawassa. DVM Thesis, Hawassa University, FVM, Hawassa, Ethiopia.
- Gebreyesus, M., 1986. Prevalence of gastrointestinal helminthes in small ruminants in Gonder Administrative Region. DVM Thesis, AAU, FVM, Debre Ziet, Ethiopia.
- Genene, R., 1994. Study on prevalence of gastrointestinal helminthes in small ruminants in and around Kombolcha. DVM Thesis, AAU, FVM, Debre Ziet, Ethiopia.
- Geremew, B., 2008. Prevalence of gastrointestinal parasites of small ruminants in and around Beddelle area. DVM Thesis, Jimma University, JUCAVM, Jimma, Ethiopia.
- Graber, M.M., 1978. Muscle cysticerciasis of Ethiopian wild and domestic ruminants. *Revue Delevage Medicine Veterinaire Pays Tropicaux*, 8: 33-37.
- Haileleul, N., 2002. Study on prevalence of gastrointestinal helminthes in small ruminants in and around Wolyta sodd, Southern Ethiopia. DVM Thesis, AAU, FVM, Debre Ziet, Ethiopia.
- Hansen, J. and B. Perry, 1994. *The Epidemiology, Diagnosis and Control of Helminth Parasites of Ruminants*. International Livestock Center for Africa, Addis Ababa Ethiopia, pp: 90-100.

- Kassahun, A., G. Getachew, A. Zelalem, A. Negussie and I. Fletcher, 1989. Small ruminant production in Ethiopia: Constraints and future prospects. Proceedings of the 3rd National Livestock Improvement Conference, May 24-26, Institute of Agricultural Research, Ethiopia, pp: 37-48.
- MAFF (Ministry of Agriculture, Fisheries and Food), 1986. Manual of Veterinary Parasitological Laboratory Techniques. Her Majesty's Stationary Office, London.
- Mohammed, K., 2008. Prevalence of gastrointestinal helminthes in small ruminants in Addis Ababa. DVM Thesis, Jimma University, JUCVM, Jimma, Ethiopia.
- Steel, M., 1996. Goats: The Tropical Agriculturalist. Macmillan Education Ltd., London and Basingstoke, pp: 160.
- Teklye, B., 1991. Epidemiology of endoparasites of small ruminants in sub-saharan Africa. Proceedings of 4th National Livestock Improvement Conference, Nov. 13-15, IAR. Addis Ababa, Ethiopia, pp: 7-11.
- Tembely, S., 1988. Small ruminant production in Ethiopia prospects for improving productivity. Proceedings of the 5th National Conference of Ethiopia Society for Animal Production, May 15-16, Ethiopia, pp: 82-90.
- Tembely, S., A. Lahlou-kassi, J.E.O. Rege, S. Sovani, M.L. Diedhiou and R.L. Baker, 1997. The epidemiology of nematode infections in sheep in a cool tropical environment. *Vet. Parasitol.*, 70: 129-141.
- Tesfalem, T., 1992. Prevalence of gastrointestinal helminthes in small ruminants in Bale administrative region. DVM Thesis, AAU, FVM, Debre Ziet, Ethiopia.
- Thrusfield, M., 2005. *Veterinary Epidemiology*. 2nd Edn., Blackwell Science Ltd., Oxford, UK., pp: 182-198.
- Urquhart, G.M., J. Armour, J.L. Duncon, A.M. Dunn and F.W. Jennings, 1996. *Veterinary Parasitology*. 2nd Edn., Blackwell Science, Oxford, UK., pp: 261-264.
- Urquhart, G.M., J. Armour, J.L. Duncon, A.M. Dunn and F.W. Jennings, 1998. *Veterinary Parasitology*. Longman Scientific and Technical Press, UK., pp: 3-122.
- Waruiru, R.M., M.N. Mutune and R.O. Otieno, 2005. Gastrointestinal parasite infections of sheep and goats in a semi-arid area of machakos district, Kenya. *Bull. Anim. Health. Prod. Afr.*, 53: 25-34.
- Yosef, S., 1993. Prevalence of ovine gastrointestinal helminthes in and around Asella. DVM Thesis, AAU, FVM, Debre Ziet, Ethiopia.