

## Prevalence and Intensity of Paramphistomum in Ruminants Slaughtered at Debre Zeit Industrial Abattoir, Ethiopia

Sintayehu Melaku and Mekonnen Addis

Microbiology and Veterinary Public Health Team, School of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma University, Jimma, Ethiopia

**Abstract:** Cross sectional study was carried out with the aims of determining the prevalence and intensity (worm burden) of *Paramphistomum* in ruminants slaughtered from October, 2010 to April, 2011 at Hashim Nur's Ethiopian Livestock and Meat Export industrialized abattoir in Debre Zeit, Ethiopia. One thousand one hundred fifty two ruminants comprising of cattle, sheep and goats (n=384 each) were subjected to routine post mortem examination for the presence of *Paramphistomum*. The overall prevalence of *Paramphistomum* infection in the study was proved to be 28.6 % (329/1152) of which 154 (40.1 %) were in cattle, 111 (28.9 %) were in sheep and 64 (16.7 %) were in goats. The mean worm burdens of *Paramphistomum* were proved to be  $270.46 \pm 471.947$ ,  $222.96 \pm 521.850$  and  $73.31 \pm 281.612$ , in cattle, sheep and goats, respectively. Highest prevalence of paramphistomosis was registered in highland shoats, 30.2% (116/384) compared with those originated from lowland, 15.4 % (59/384). In the current study the prevalence was proved to be higher in adult shoats than young shoats with prevalence of 30.5 % (117/384) in adult and 15.1% (58/384) in young shoats. Infection was known to be highest in poor body conditioned animals (76.3 %), followed by medium (23.9 %) and good (6.9 %) body conditioned animals. A statistically significant difference ( $p < 0.05$ ) of Paramphistomosis prevalence was observed on the basis of species, body condition, different age groups and agro climatic zones (origins) of shoats. The high level of Paramphistomosis in cattle, sheep and goats in the present study represents high rate of infection and immense economic losses to the country, Ethiopia. In line with this finding it is recommended that farmers who rear cattle, sheep and goats should improve provision of feeds to their animals so that the animal can have good body condition that confers some level of resistance against *Paramphistomum* infections. Besides, they should be able to regularly treat their animals with the appropriate anthelmintics and awareness should be created on the prevention and control methods of *Paramphistomum* infections so as to reduce the huge economic losses which could result from this pathogenic endoparasite in Ethiopia.

**Key words:** Abattoir • Prevalence • Intensity • Paramphistomum • Ruminants • Debre Zeit • Ethiopia

### INTRODUCTION

*Paramphistomum* is one of the common parasites in the rumen and reticulum of sheep, goats, cattle and water buffaloes. Light infection doesn't cause serious damage to the animals, but massive number of immature *Paramphistomum* can migrate through intestinal tract causing acute parasitic gastroenteritis with high morbidity and mortality rates, particularly in young animals. *Paramphistomum* in duodenum and ileum are plug feeders and cause haemorrhage which leads to bleeding and diarrhea and bleeding for prolonged period may cause

anaemia, which further weaken the host. Mature *Paramphistomum* are also responsible for ruminitis, irregular rumination, unthriftiness, lower nutrition conversion and loss of body condition, decrease in milk production and reduction of fertility [1, 2].

Paramphistomosis is distributed all around the world, but the highest prevalence has been reported in tropical and sub tropical regions, particularly in Africa, Asia, Australia, Eastern Europe and Russia. The epidemiology of *Paramphistomum* is determined by several factors governed by parasite-host-environment interactions. The major epidemiological variable influencing worm

burdens of animals is the infection rate from pastures. It is also influenced by the climatic requirement for egg hatching, development and survival of the larvae in pasture [3].

In spite of the aforementioned prevailing situation and the presence of a number of problems due to gastrointestinal parasites there is paucity of well-documented information on the occurrence of *Paramphistomum* in ruminants in Ethiopia. Therefore, the study was designed with the aims of determining the prevalence and worm burden (intensity) of *paramphistomum* in cattle, sheep and goats slaughtered at Hashim Nur's Ethiopian livestock and meat export industrialized abattoir in Debre Zeit, Ethiopia.

## MATERIALS AND METHODS

**Description of the Study Area:** The study was conducted at Hashim Nur's Ethiopian Livestock and Meat Export industrialized abattoir in Debre Zeit town, Ethiopia. Debre Zeit is located about 45 km South-east of Addis Ababa, just on the escarpment of the Great Rift Valley and the geography of the area is marked by creator lakes. It is found at 9°N latitude and 40°E longitude and at an altitude of 1850 meters above sea level in the central high lands of Ethiopia. It has a human population of about 95,000. It experiences a bimodal pattern of rainfall with the main rainy season extending from June to September (of which 84% of rain is expected) and a short rainy season from March to May with an average annual rainfall of 800mm. The mean annual minimum and maximum temperatures are 12.3 °C and 27.7 °C, respectively, with an overall average of 18.7 °C. The mean relative humidity is 61.3% [4].

**Study Population and Sampling Technique:** The study populations were cattle, sheep and goats of different ages and body conditions brought from different parts of the country to the abattoir for the purpose of meat production. Simple random sampling method was used to select the study units.

**Study Type and Sample Size Determination:** A cross-sectional study was used to determine the prevalence of *Paramphistomum* infection in cattle, sheep and goats slaughtered at Hashim Nur's Ethiopian Livestock and Meat Export industrialized abattoir from October, 2010 to April, 2011. To calculate the total 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 *Paramphistomum*, the sample size was determined using the formula given in Thrusfield [5].

$$n = \frac{1.96^2 * P_{exp} (1-P_{exp})}{d^2}$$

n = required sample size,

P<sub>exp</sub> = expected prevalence,

d = desired absolute precision

Therefore, based on the above formula the total sample sizes of cattle, sheep and goats were calculated to be 384 each.

### Study Methodology

**Ante Mortem Examination:** Ante mortem inspection was carried out on the animals before slaughter to assess their general health status. During each sampling, the animals were identified by giving my own identification i.e. tying rope on neck for each animal and the general physical examinations of animals were conducted.

**Post Mortem Examination:** The rumen and reticulum of slaughtered animals which were selected to be sampled were inspected for the presence of rumen flukes. The collected flukes were transported to the laboratory in plastic container with 4% formalin. The samples were carefully labeled with type of species, dental age, origin of animal and place of collection. Then the collected flukes were washed several times in running tap water to remove the debris and ruminal content. Finally, these flukes were prepared for identification under stereo microscope. Furthermore, collected flukes from each animal were counted to determine the intensity (worm burden) of infections.

**Identification of *Paramphistomum*:** For identification, the collected flukes were placed on Petri dish and observed through stereo microscope to appreciate the morphology. Final identification of *Paramphistomum* was done based on morphology of flukes; shape, posterior sucker (acetabulum), anterior sucker, terminal genitalium and tegumental papillae following the standard guidelines given by Urquhart *et al.* [6].

**Data Analysis:** Percentages to measure prevalence and Chi-Square ( $\chi^2$ ) test were employed to measure association between the parasitism and species of the animals, age, origin and body condition. The worms were

estimated as mean number of worms with respective standard deviation of mean and range (Maximum-Minimum worm) in each species. The data was analyzed using statistical packages MINTAB software Version 16 and SPSS for windows. In all analyses, Confidence level was held at 95 % and P<0.05 for significance.

**RESULTS**

**Prevalence and Distribution of *Paramphistomum* in Ruminants:** The overall prevalence of *Paramphistomum* infection in ruminants (cattle, sheep and goats) was found to be 28.6 % (329/1152). The identification results showed that the prevalence of *Paramphistomosis* was higher in cattle (40.1%) followed by sheep and goats with prevalence of 28.9% and 16.7%, respectively (Table 1).

The prevalence of paramphistomosis was proved be higher 30.2% (116/384) in shoats originated from highlands than those originated from lowlands 15.4 % (59/384). There was statistically significant difference (p<0.05) in the prevalence of *Paramphistomum* infections between altitudes (Table 2).

Higher prevalence of paramphistomosis 30.5 % (117/384) was recorded in Adult shoats than in young shoats where the prevalence was observed to be 15.1% (58/384). There was statistically significant difference (p<0.05) on the prevalence of *Paramphistomum* between age groups of investigated shoats (Table 3).

The identification result showed the prevalence of *Paramphistomum* in sheep that originated from highland was confirmed to be higher, 32% (8/25) than sheep of the same age group from low land areas, 16.79% (22/131). Likewise, the prevalence of paramphistomosis was higher in adult sheep from high lands, 37.04% (70/189) than sheep of the same age category from lowland areas 30.77% (12/39) (Table 4).

Young goats from highland areas were more infected with prevalence of 20.51% (8/39) with *Paramphistomosis* than goats of the same age category in lowland areas where the prevalence was identified to be 10.58% (20/189). Similarly, the prevalence of paramphistomosis in adult goats that originated from highland areas was 23.66 % (31/131) and it was found to be 20% (5/25) in goats of the same age in lowland areas (Table 5).

The highest prevalence (76.3%) of *Paramphistomum* infection was recorded in poor body conditioned animals followed by medium and good body conditioned ones with specific prevalence of 23.9% and 6.9% respectively (Table 6).

Table 1: The overall prevalence of paramphistomosis in cattle, sheep and goats

Species	Examined	Prevalence (%)	x <sup>2</sup> -value	p-value
Cattle	384	40.1	51.727	0.000
Sheep	384	28.9		
goats	384	16.7		
Total	1152	28.6		

Table 2: Prevalence of paramphistomosis in shoats from high land and lowland areas

Origin	Examined	Prevalence (%)	x <sup>2</sup> -value	p-value
High land	384	30.2	24.045	0.000
Low land	384	15.4		
Total	756	22.8		

Table 3: Prevalence of Paramphistomosis in young and adult shoats

Age	Examined	Prevalence (%)	x <sup>2</sup> -value	p-value
Young	384	15.1	25.762	0.000
Adult	384	30.5		
Total	768	22.8		

Table 4: Prevalence of paramphistomosis in ovine in relation to age and altitude

Description	Examined	Prevalence (%)
Ovine young highland	25	32
Ovine young lowland	131	16.79
Ovine Adult highland	189	37.04
Ovine Adult lowland	39	30.77%

Table 5: Prevalence of paramphistomosis in caprine in relation to age and altitude

Description	Examined	Prevalence (%)
Caprine young highland	39	20.51
Caprine young lowland	189	10.58
Caprine Adult highland	131	23.66
Caprine Adult lowland	25	20

Table 6: Prevalence of paramphistomosis in relation to body condition

Condition	Cattle	Sheep	Goats	Total Prevalence (%)
Poor	118 (82.5 %)	77 (75.5 %)	34 (61.8 %)	229 (76.3 %)
Medium	17 (26.2 %)	19 (20.7%)	22 (25.6 %)	58 (23.9 %)
Good	19 (10.8 %)	15 (7.9%)	8 (3.3 %)	42 (6.9%)

Table 7: Intensity of *Paramphistomum* infection

Species	Worm burden (range)	Mean±SD
Ovine	8-2753	222.96 ±521.850
Caprine	11-2517	73.31± 281.612
Bovine	12-2076	270.46 ± 471.947
Total	8-2517	188.91± 445.181

**Intensity (Worm Burden) of *Paramphistomum* in Ruminants:** The worm burden of *Paramphistomum* in the examined animals was found to be high in ovine followed by cattle and goats (Table 7).

## DISCUSSION

The overall prevalence of Paramphistomosis in ruminants (cattle, sheep and goats) was found to be 28.6 % (329/1152). The identification results showed that the prevalence of *Paramphistomum* infection was higher in cattle (40.1%) than sheep and goats with prevalence of 28.9% and 16.7%, respectively. Raza *et al.* [7] recorded 22 % prevalence in Pakistan; Kanyari *et al.* [8] recorded 30 % prevalence in Kisumu Municipality abattoir in Kenya. Lower prevalence of Paramphistomosis (3.06 %) was recorded by Agosti *et al.* [9] in Kozakiewiez, Poland.

Statistical analysis has indicated that there was significant variation in prevalence of paramphistomosis among cattle, sheep and goats ( $P < 0.05$ ); with highest prevalence in cattle (40.1%) followed by sheep (28.9 %) and goats (16.7 %). The variation in the prevalence of paramphistomosis among species may be explained by the fact that cattle have indiscriminate type of grazing behaviour and goats do not usually graze in marshy areas, where there is less chance of acquiring the infection. In addition, goats are browsers by nature and they tend to graze in very rare cases and there is low probability of picking of the metacercaria of *Paramphistomum* along with grass.

The prevalence of *Paramphistomum* in cattle was proved to be 40.1% in the current study. Similar prevalence were recorded by Mogdy *et al.* [2] who recorded 38.92 % in Egypt and Bouvry and Rau [10] who confirmed the prevalence of *Paramphistomum* in cattle to be 34 % in Canada. Lower prevalence of *Paramphistomum* in cattle was recorded by Ozdal *et al.* [3] who recorded 8.95 % prevalence in Turkey. Similarly, Titi *et al.* [11] recorded 12% prevalence of *Paramphistomum* in cattle in Algeria and Haridy *et al.* [12] indicated the prevalence of *Paramphistomum* in cattle to be 7.3 % in Egypt. Higher prevalence of *Paramphistomum* in cattle was recorded by Manna *et al.* [13].

Similar prevalence of *Paramphistomum* in sheep with the present research was recorded by Raza *et al.* [7] with prevalence of 28.57 % in Pakistan and Njoku-Tony and Nwoku [14] who recorded 26.2 % prevalence in Nigeria. Higher prevalence of *Paramphistomum* in sheep was recorded by Manna *et al.* [13] who recorded 55.9 % in India. Lower prevalence was recorded by Mogdy *et al.* [2] who recorded 7.06 % in Egypt.

Similar prevalence of *Paramphistomum* in goats with the present research was recorded by Raza *et al.* [7] who recorded 19.8 % in Pakistan. Lower prevalence of *Paramphistomum* in goats was recorded by Manna *et al.* [13] with prevalence of 7.07 % in India.

These different prevalence of *Paramphistomum* in these reports could be explained either by the different parasitological techniques used in these studies, differences in the origin of the samples or by geographical differences. Other factor which attributes for such a difference could be due to suitable ecological factors for the snail intermediate host of *Paramphistomum* in these areas.

It was observed that there was significant variation ( $P < 0.05$ ); in prevalence of paramphistomosis between young and adult shoats ( $P < 0.05$ ); with more prevalence (30.5 %) in adult and relatively less (15.1 %) in young. The lower rate of infection in young animals may be attributed to the little chance of exposure to contaminated pasture and do not travel long distance to get their food where contaminated pasture present.

Higher mean worm count was registered in sheep with mean worm count of  $222.96 \pm 521.850$  and lowest in goats with mean worm count of  $73.31\% \pm 281.612$ . Comparison of the mean worm counts showed that there was significant variation ( $P < 0.05$ ) between the two species. This variation may be due to the density and up take of the specific metacercaria in the definitive host as justified by [15]. In the current study, animals with poor body condition had higher intensity than those in good body condition, suggesting that they could be affecting the productivity of the small ruminants.

Similar mean worm count was recorded by Yabe *et al.* [16] with mean worm count of  $282.53 \pm 478.741$  in cattle in Zambia. Higher mean worm count was recorded by Titi *et al.* [11] with mean worm count of  $984.1 \pm 478.741$  in Algeria and lower mean worm count was recorded by Ozdal *et al.* (2010). The mean worm count was highest in sheep comparing with other findings: Ozdal *et al.* [3] who recorded  $97.55 \pm 12.50$ .

## CONCLUSION

*Paramphistomum* is an important helminth diseased and one of the major obstacle for live stock development in Ethiopia causing remarkable direct and indirect losses at different parts of the country. Their occurrence is closely linked to the presence of biotypes suitable for the development of snail intermediate hosts. The study confirmed that there was significant difference in the prevalence of the *Paramphistomum* among the different species, ages and body condition scores of the cattle, sheep and goats examined and it is shown that *Paramphistomum* parasites were proved to be more prevalent in ruminants with poor body condition than medium and good conditioned animals.

The high level of *Paramphistomum* in cattle, sheep and goats in the present study represent high rate of infection and immense economic losses to the country. In line with this finding it is recommended that farmers who rear cattle, sheep and goats should improve provision of feeds to their animals so that the animal can have good body condition that confers some level of resistance against *Paramphistomum* infections. Besides, they should be able to regularly treat their animals with the appropriate anthelmintics and awareness should be created on the prevention and control methods of *Paramphistomum*.

#### ACKNOWLEDGEMENTS

The work incorporated in this research was undertaken using the research grant allocated by School of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma University. The researchers are grateful to the University in particular and government of Ethiopia, in general, for providing us the research fund.

We wish to extend our profound gratitude to at Hashim Nur's Ethiopian Livestock and Meat Export industrialized abattoir without the cooperation and enthusiasm shown by it, the study would not have been possible.

#### REFERENCES

1. Rangel-Ruiz, L., S. Albores and J. Gamboa, 2003. Seasonal trends of *Paramphistomum cervi* in Tabasco. Mexico. *Journal of Veterinary Parasitology*, 16: 217-222.
2. Mogdy, H., T. Al-Gaabary, A. Salama, A. Osman and G. Amara, 2009. Studies on paramphistomiasis in ruminants in Kafrelsheikh. *Journal of Veterinary Medicine*, 10: 116-136.
3. Ozdal, N., A. Gul and S. Deger, 2010. Prevalence of *paramphistomum* infection in Cattle and sheep in Vanprovince, Turkey. *Helminthologia*, 47: 20-24.
4. CSA, 2006. Central Statistical Authority, agricultural sample survey, Report on livestock 2007/2008. Statistical bulletin 361, Addis Ababa, Ethiopia.
5. Thrustfield, M., 2005. *Veterinary Epidemiology*. 3<sup>rd</sup> Edition, Black Well Science Ltd. Cambridge, USA. pp: 225-228.
6. Urquhart, G.M., J. Armour, J.L. Duncan, A.M. Dunn and F.W. Jennings, 1996. *Veterinary parasitology*, 2<sup>nd</sup> edition, University of Oxford, Long man scientific and technical press, UK, pp: 100-109.
7. Raza, M., S. Murtaza, H. Bachaya and A. Hussain, 2009. Prevalence of *Paraphistomum cervi* in ruminants slaughtered in district Muzaffargarh. *Pakistan Veterinary Journal*, 29: 214.
8. Kanyari, P., W. Kagira and R. Mhoma, 2009. Prevalence and intensity of endoparasites in small ruminants kept by farmers in Kisumu Municipality, Kenya. *Livestock Research for Rural Development*, 21: 12-15.
9. Agosti, M., E. Cavalletti and O. Pozza, 1980. Bovine paramphistomiasis in the province of Milan. *Clinica-Veterinaria*, 103: 284-296.
10. Bouvry, M. and M. Rau, 1984. *Paramphistomum* species in dairy cattle in Quebec. *Canada Veterinary Journal*, 25: 353-356.
11. Titi, A., A. Mekroud, S. Sedraoui, P. Vignoles and D. Rondelaud, 2010. Prevalence and intensity of *Paraphistomum daubneyi* infections in cattle from north-eastern Algeria. *Journal of Hematology*, 84: 177-181.
12. Haridy, F., J. Sherbiny and T. Morsy, 2006. Some parasitic flukes infecting farm animals in AL-Santa Center, Gharibia Governorate, Egypt. *Journal of Egyptian Society of Parasitology*, 36: 259-264.
13. Manna, A., S. Prmanik and G. Mukherjee, S. 1994. Incidence of paramphistomiasis in West Bengal. *Indian Journal of Animal Health*, 33: 87-89.
14. Njoku-Tony, R. and B. Nwoko, 2009. Prevalence of paramphistomiasis among sheep slaughtered in some selected abattoirs in IMO state, Nigeria. *Science World Journal*, 4: 12-15.
15. Szmidi-Adjide, V., M. Abrous, C. Adjide and G. Drey, 2000. Prevalence of *Paramphistomum daubneyi* in central France. *Veterinary Parasitology*, 87: 133-138.
16. Yabe, J., A. Phiri, K. Phiri, M. Chembensofu, P. Dorny and J. Vercruysse, 2008. Concurrent infections of *Fasciola*, *Schistosoma* and *Amphistomum* Spp. in cattle from Kafue in Zambia. *Journal of Helminthology*, 82: 373-376.