Prevalence of Paramphistomum Nematode Parasites in Small Ruminants Slaughtered at Abergelle International Export Abattoir, Tigray, Ethiopia

Girma Sahlemarium, Etsay Kebede, Habtom Kiros Bitsue
College of Veterinary Medicine, Mekelle University, P.O.Box: 2080, Mekelle, Ethiopia
*Corresponding author: E-mail: etsaykebed1616@gmail.com

ABSTRACT
A cross sectional study was carried out with the aim for of determining the prevalence and adult worm load of Paramphistomum in small ruminants slaughtered from November, 2017 to March, 2018 at Abergelle international export abattoir in Tigray, North Ethiopia. A total of 400 fecal samples from sheep and goats of different age, body condition, and market source were collected randomly from abattoir. The prevalence of Paramphistomosis was 27.77% in sheep and 15.0% in goats with an overall prevalence of 20.75 %. In the current study the prevalence was proved to be higher in adult 61% (61/100) than young 7.3% (22/300) sheep and goats. Infection was known to be highest in poor body condition (35.7%), medium (18.75%) and good (5.1%). The highest prevalence 36.36% of Paramphistomosis was recorded in shoaits brought from Semen Gonder and 14.85%, 10.3% and 10% from Abergelle, Afar and Sekota respectively. The mean adult worm load of Paramphistomum was 218.46±369.428 in sheep and 70.97±87.596 in goats. There was a significant difference in Paramphistomosis infection between sheep and goats (p = 000) and between the species, age groups, body condition, and area of origin of animals (p<0.05). Paramphistomosis leads to poor body condition hence, owners need to improve feed supply, be aware of exposure factors of the disease, the disease requires future professional attention on treatment, control, identification of paramphistomum species and their economic losses incurred in respective areas.

Key words: Abergelle; Paramphistomum; Prevalence, sheep, goat

INTRODUCTION
Ethiopia has one of the largest livestock populations in Africa. According to (CSA, 2015), the country has 57.83 million cattle, 29.33 million sheep, 29.11 million goats, 1.23 million camels, 60.51 million poultry, 2.08 million horses, 0.41 million mules and 7.88 million donkeys (CSA, 2015). Livestock play an important role in providing export commodities including hides and skins. However, constraints such as the traditional management system of livestock, limited genetic potential of the indigenous animal breeds and prevalence of many livestock diseases, lack of appropriate disease control policy and veterinary services the potential of livestock based economy has been reduced. Among parasitic diseases Paramphistomosis was one that cause lowering their productivity (Yasin, 2017).

Paramphistomosis is considered to be one of the most important parasitic diseases affecting livestock worldwide and the scenario is worst in tropical and subtropical regions (Phiri et al., 2007). The highest prevalence has been reported in tropical and sub-tropical regions, particularly in Africa, Asia, Australia, Eastern Europe and Russia (Ozal et al., 2010).
Paramphistomum, or rumen fluke, are the most common parasites in the rumen and reticulum of cattle, buffalo, sheep, deer, goat and other ruminants. They are trematode phylum of helminthes and have a life-cycle similar to that of Fasciola hepatica. G. truncatula has been shown to act as intermediate host for rumen fluke in France (Abrous et al., 2000) and this has also been confirmed in Great Britain (Jones et al., 2015). Following ingestion of metacercariae by the final host, the juvenile rumen fluke can be found in the small intestine where they attach to the mucosa and grow before they migrate to the rumen (De Waal, 2010). Adult Rumen fluke live attached to the surface of the rumen and reticulum and have a light to bright red color when fresh, are pear-shaped and about 1.0 cm in length (Taylor et al., 2007).

Adult flukes in the stomach lay eggs that are shed outside with the feces. Once embryonated, the eggs hatch to release miracidia, which are temporarily free-moving within the environment. About 2 weeks later miracidia hatch out of the eggs, they swim in the water until they find a suitable snail (Junquera, 2014). The immature paramphistomum penetrate the duodenal mucosa and migrate to the rumen where adult parasites attach to the luminal surface with their large posterior suckers (acetabula), feeding on luminal contents (Cauquil et al., 2016).

In Ethiopia, Paramphistomosis has been reported from different parts of the country with approximately 45.83% in western Gojam by Yeneneh, (2012), 28.6% in Debre Zeit by Melaku and Addis, (2012), 6.7% in Hawassa by Tagesse, (2014) and 49.44% in Ashange, Tigray by Tsegabrihan, (2012). Many of these studies were mainly in cattle but not in sheep and goats and used fecal examination. Massive number of immature Paramphistomum can migrate through upper small intestine causing acute parasitic gastroenteritis with high morbidity and mortality rates, particularly in young animals Paramphistomum in duodenum and ileum are plug feeders and cause hemorrhage which leads to bleeding. This causes anemia which further weaken the host and also produce diarrhea. Mature Paramphistomum also causing ruminitis, irregular rumination, lower nutrition conversion and loss of body condition and reduction in animal fertility (Melaku and Addis, 2012).

According to the above major reasons which were less attention on small ruminant Paramphistomosis, reduces production and productivity, past study done majorly focuses on fecal examination and affects culturally edible organs of the study area made the problem to be researcachable. Therefore, the study was designed to determine the prevalence and adult worm load of small ruminant Paramphistomum and examine the contribution of risk factors in association with Paramphistomosis at Abergelle international export abattoir in Mekelle, Ethiopia.

**MATERIALS AND METHODS**

**Study area**

The present study was conducted from November 2017 to March 2018 at Abergelle international export abattoir. It is located at a distance of 12 km from the center of the town to North West of Mekelle city. Mekelle is the capital city of Tigray regional stat, which is located at a distance of about 783 km away from Addis Ababa. It is located in the Northern extreme of Ethiopia extending from 33º 25” to 39º 38” north latitude and from 36º 27” to 40º 18” east longitudes at an average altitude of 2000 - 2200 meter above sea level(masl). The mean annual rain fall ranges from 450-500mm and the temperature varies from 12ºc in November and December to 27ºc in January and March. Its rainy seasons occur mainly between June and September although short
rainy seasons do occur on March and April (TRHD, 2008).

**Study population**

The study animals were sheep and goat of different ages, body conditions and their sources were Semen Gondar (around Tekeze River), Abergelle, Sekota and Afar areas to be slaughtered in the export abattoir. Those animals with the age of less than one year and above one year were grouped as young and adult respectively by looking dentation in animals (Samuel et al., 2016) and Gatenby, (1991). The body condition score were also recorded using the criteria as stated by (Suiter, 2006).

**Study design and sample size determination**

A cross sectional study was conducted to determine the prevalence of Paramphistomum and its associated risk factors in small ruminants at Abergelle international export abattoir in Mekelle. In this study, the sample size determination was undertaken using random sampling method for a given population at expected prevalence of small ruminant Paramphistomum at 5% desire absolute precision and 95 confidence interval (Thrusfield, 2005) Since there is limited previous studies done on Paramphistomum, 50% expect prevalence was used to calculate as per the following formula.

\[
N = \frac{1.96(P_{exp})(1 - P_{exp})x^2}{D^2}
\]

Where, \( n \) = minimum number of sample size,
\( z \) = 1.96 at 95% level of confidence
\( d \) = absolute precision,
\( P_{exp} \) = expected prevalence

Hence, the total numbers of small ruminant sampled using the formula were 384.Morever to increase the sample size arbitrarily 16 sheep and goats were added which the total was 400.

**Data collection**

**Fecal sample collection:** A few hours before slaughter ante mortem investigations were performed and were recorded for each animal concerning its sources, species, age and body condition score. The fecal samples for parasitological examination were collected directly from the rectum of each animal using disposable plastic gloves and place in each clean and labeled screw-capped universal bottle. All fecal sampled were preserved in 10% formalin solution.

**Laboratory examination of feces:** The collected sample specimens were processed and examined at College of Veterinary Medicine parasitology laboratory, Mekelle University. The laboratory technique used was sedimentation method and stained with 5% of methylene blue for the presence and absence of Paramphistomum eggs (Anne and Gary, 2017).

**Post mortem examination:** Initially, the offals of the sampled animals was given the same code as the ante mortem examination. Then, post mortem examination was conducted through visual inspection and counting of the adult Paramphistomum parasites present in the rumen and reticulum of slaughtered animals was also done (Melaku and Addis, 2012).
Data analysis

The data were filled and managed using a Microsoft Excel spread sheet and analyzed with Statistical Package for Social Sciences (SPSS) version (20). The prevalence of Paramphistomosis was determined as a proportion of affected animals out of the total animals. The differences or association between different risk factors such as animal source, species, age, and body condition in relation to disease condition was analyzed by using $\chi^2$ (Chi-square) technique, percentage and value of $p<0.05$ for considering as significant.

RESULTS

Out of 400 small ruminants (sheep 180 and goats 220) examined, the overall prevalence of Paramphistomum infestation was found to be 20.75% (83/400). The prevalence of Paramphistomosis was higher in sheep 27.77% and lower (15.0%) in goats. There was statistically significant difference ($p=0.000$) on the prevalence of Paramphistomum between examined sheep and goats (table 1).

Higher prevalence of Paramphistomosis (61%) was recorded in adult than in young sheep and goats (7.3%). There was statistically significant difference ($p=0.000$) in the prevalence of Paramphistomum between age groups of sheep and goats (table 2).

Out of the total 400 sheep and goats examined, 126, 176 and 98 were categorized as having poor, medium and good body condition score respectively. The prevalence of this parasite based on body condition were 35.7%, 18.75% and 5.1% with poor, medium and good respectively. Rumen fluke of sheep and goats, prevalence was high in poor body condition score categories with statistically significant variation ($p=0.000$) (table 3).

Based on source of the sampled sheep and goats higher prevalence of 36.36% was found from Semen Gonder and followed by Abergelle 14.85%, Afar 10.3% and Sekota 10%. However, the prevalence was statistically significant difference ($p=0.000$) (table 4). During the study period the high worm burden of Paramphistomum was found in sheep and was followed by goats (table 5).

DISCUSSION

The overall prevalence of (20.75%) paramphistomosis was found in small ruminant those were slaughtered that slaughtered at Abergelle Abattoir. Higher findings were reported by Melaku and Addis, (2012) in Debrezeit to be 28.9%. Similar prevalence of Paramphistomum in sheep was also reported by Tsegabirhan et al. (2015) to be 23.7%, in Ashange Tigray, Njoku-tony and Nwoku (2009) 26.2%, in Nigeria, Raza et al. (2009) 28.57% in Pakistan. However lower prevalence (7.06%) was recorded by Mogdy et al. (2009) in Egypt. These differences might be due to techniques applied to detect Paramphistomosis and geographical location of the studies made. The prevalence in sheep was 27.77% and goats 15%. This had similarity with regard to goats which was 19.8% as reported by Raza et al. (2009) in Pakistan and 16.7% by Melaku and Addis, (2012). There was statistical significant difference ($p=0.000$) in the prevalence of Paramphistomosis between sheep and goats, indicating that sheep are more susceptible than
goats to the infection. The variation in prevalence might be as sheep graze nearer to ground but not usually goats.

The prevalence of sheep and goats Paramphistomosis was proved to be higher 61% in adult than 7.3% in young sheep and goats and there was significant difference (p=0.000) in the prevalence of Paramphistomosis with respect to the age. In this study young animals had a low prevalence rate than adult which agrees with those of Melaku and Addis, (2012) in adult 30.5% and young 15.1% and Tsegabirhan et al. (2015) in adult 34.72% and young 11.11%.

Relationship between body condition and prevalence of Paramphistomosis in sheep and goat was recorded. Accordingly the the prevalence was 35.7%, 18.75% and 5.1% with poor, medium and good respectively. This finding agrees with Melaku and Addis, (2012). The prevalence had significant difference (p=0.000) in poor body condition (p=0.000) compared with medium and good levels. This can be due to lower in immunity.

Based on market sources of slaughtered sheep and goats the highest prevalence (36.36%) of Paramphistomosis was in Semen Gonder and followed by Abergelle (14.85%, Afar (10.3%), Sekota (10%) and had significant difference (P=0.000). This differences seems because of more animals were coming accordingly and environmental suitability to the parasite. More ever area based differences agrees with Tsegabirhan et al. (2015) which was the highest in Adibomsa 41.46% and lower in Debri 12.90% and also in highland 30.2% and lowland 15.4 % as reported by Melaku and Addis, (2012). In the study period the highest mean worm burden counts in sheep was 218.46±369.428 and the lowest in goats with the mean of 70.97±87.596 and had significant difference (P=0.05) between sheep and goats. This variation is due to counting technique, density of worm and up take of infective larvae in to the final host as reported by Szmidt-Adjide, (2000). The mean worm burden more or less comply with Melaku and Addis (2012) in sheep 222.96±521.850 and in goats 73.31± 281.612. The lowest mean worm count (97.55±12.50.) was registered by Ozdal et al. (2010) which could be due to geographical, breed and other differences.

In conclusion, the overall prevalence of paramphistomosis was higher and more was observed on sheep when compared with goats. This disease was most common on sheep, on both species of adult, poor body condition and in defined market sources of these animals. The -intensity of the parasite is higher in sheep than in goats. There was significant deference between paramphistomum, type of host, age, body condition and market sources as identified risk factors. Therefore the following recommendations are forwarded: farmers who rear sheep and goats should improve their feed supply so that the animal can have good body condition that can build some level of resistance against Paramphistomosis; as the burden of Paramphistomum is high veterinary professionals should give attention for the treatment and control of Paramphistomosis and awareness creation on owners related to risk factors of paramphistomosis by major on sheep.

ACKNOWLEDGEMENTS

The authors would like to thank Mekelle University, College of veterinary medicine and Abergelle export abattoir for overall support made for permitting to conduct this research.
REFERENCES


Jones, R., Williams, H., Dalesman, S. & Brophy, P. 2015. Confirmation of *Galba truncatula* as an intermediate host snail for *Calicophoron daubneyi* in Great Britain, with evidence of alternative snail species hosting *Fasciola hepatica*. Parasite Vectors, 8: 656.


Table 1: The overall prevalence of Paramphistomosis in sheep and goats in the study area

<table>
<thead>
<tr>
<th>Species</th>
<th>No. examined</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>180</td>
<td>50 (27.77%)</td>
</tr>
<tr>
<td>Goat</td>
<td>220</td>
<td>33 (15.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>83 (20.75%)</td>
</tr>
</tbody>
</table>

$\chi^2$ value = 9.829; $P$-value = 0.002; df = 1

Table 2: Prevalence of Paramphistomosis in young and adult sheep and goats

<table>
<thead>
<tr>
<th>Age</th>
<th>No. Examined</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>300</td>
<td>7.3%</td>
</tr>
<tr>
<td>Adult</td>
<td>100</td>
<td>61%</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>34.15%</td>
</tr>
</tbody>
</table>

$\chi^2$ value = 131.357; $P$-value = 0.000; df = 1

Table 3: Prevalence of Paramphistomosis in relation to body condition

<table>
<thead>
<tr>
<th>Body condition</th>
<th>No. Examined</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>126</td>
<td>45 (35.7%)</td>
</tr>
<tr>
<td>Medium</td>
<td>176</td>
<td>33 (18.75%)</td>
</tr>
<tr>
<td>Good</td>
<td>98</td>
<td>5 (5.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>83 (27.7%)</td>
</tr>
</tbody>
</table>

$\chi^2$ value = 32.178; $P$-value = 0.000; df = 2

Table 4: Prevalence of Paramphistomosis in relation to source of animals

<table>
<thead>
<tr>
<th>Sources</th>
<th>No. Examined</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semen Gonder (around Tekeze)</td>
<td>143</td>
<td>52 (36.36%)</td>
</tr>
<tr>
<td>Abergelle</td>
<td>101</td>
<td>15 (14.85%)</td>
</tr>
<tr>
<td>Afar</td>
<td>116</td>
<td>12 (10.3%)</td>
</tr>
<tr>
<td>Sekota</td>
<td>40</td>
<td>4 (10%)</td>
</tr>
<tr>
<td>Total</td>
<td>400</td>
<td>83 (20.75%)</td>
</tr>
</tbody>
</table>

$\chi^2$ value = 33.785; $P$-value = 0.000; df = 3

Table 5: Adult worm load of Paramphistomum infestation in sheep and goat

<table>
<thead>
<tr>
<th>Species</th>
<th>Adult (range)</th>
<th>mean± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep (ovine)</td>
<td>5-1504</td>
<td>218.46±369.428</td>
</tr>
<tr>
<td>Goat (caprine)</td>
<td>3-500</td>
<td>70.97±87.596</td>
</tr>
</tbody>
</table>