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Prevalence of Small Ruminants Fasciolosis in Mekelle, Tigrai Regional State, Northern Ethiopia

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Authors' contributions

This work was carried out in collaboration among all authors. Author BMM has been involved in proposal writing and laboratory analysis and manuscript preparation. Author AAA involved in designing, proposal writing, sample collection, laboratory analysis and data managing. Author HKB involved in laboratory analysis, data managing and manuscript preparation. All authors read and approved the final manuscript.

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ABSTRACT

Fasciolosis is one of the most economically important and widespread parasitic diseases of domestic animals. Accordingly, a cross sectional study was conducted in Mekelle, northern Ethiopia to assess the prevalence of small ruminants Fasciolosis. Fecal samples were collected from a total of 384 small ruminants comprising of 245 sheep and 139 goats and were examined by using the sedimentation technique to find out the eggs of *Fasciola* species. Out of the total, 384 examined fecal samples, 67 were found to be positive for Fasciolosis with an overall prevalence rate of 17.5 percent. The prevalence of Fasciolosis was higher in sheep (24.1%) as compared to goats (5.8%). There was a statistically significant difference (*P=.00*) among sheep and goats as regards to the occurrence of *Fasciola* spp. With body condition scores of the animals, Fasciolosis was statistical significant (*P=.00*) which was higher in animals with poor body scores followed by medium and good body conditions, respectively. However, the prevalence of Fasciolosis between males and females *(P=.19)* as well as young and adult animals (*P=.92*) was not statistically significant difference. The result among the origins of the animals also revealed that no statistically

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significance difference (*P=.81*). In conclusion, the burden of Fasciolosis still remains a great problem in the study area. Thus, we need for further investigation to study the impact of the disease on animal production and its economic values and requires integrated interventional strategies to be implemented to tackle such an economically important disease of small ruminants.

Keywords: Fasciolosis; goats; Mekelle; sheep.

1. INTRODUCTION

The livestock sector in Ethiopia contributes 40% of the global value of agricultural output thus supporting the livelihood and food security of almost a billion people [1]. It is believed to have the 10th largest livestock population in the world with top-ranked in Africa. The country is a home for about 59.5 million cattle, 30.70 million Sheep and 30.20 million goats [2]. Out of total cattle population, 98.2% are local breeds and the remaining are exotic/cross breeds. Similarly, 72.14% and 70.61% were female sheep and goats, respectively. About 27.86% and 29.39% were male sheep and goats, respectively. Nearly, 99.8% of the sheep and all (100%) goat population of the country are local breeds [2]. In Ethiopia, this most important domestic livestock provides animal protein that contributes to the improvement of the nutritional status of the people. They also play an important role in providing export commodities like skins to earn foreign exchanges to the country [3]. Sheep and goats have many advantages over large ruminants for most smallholder farmers such as fewer feed costs, quicker turnover and easily manageable and appropriate sizes to handle at abattoir [4]. The increase in international demand for meat in general and the high demand for sheep and goat's meat from the middle east countries is also another incentive for Ethiopia to increase the production [5].

Despite the large population of small ruminants in the country, their potential uses were hampered by widespread diseases, inadequate feed, and insufficient infrastructure [6]. Fasciolosis known as liver fluke is one of the most common economically important and widespread parasitic diseases of domestic livestock particularly in cattle, sheep and goats [7]. The disease is caused by digenean trematodes of the genus *Fascio*la [8]. The two most commonly species implicated are *Fasciola hepatica* and *Fasciola gigantica* [9].

Fasciola hepatica has a worldwide distribution, but predominates in temperate zones, while *F. gigantica* is found in most continents, primarily in the tropical regions [10].

However, the species of these two *Fasciola* could occur in the same country as well as in the same areas of the agro-ecological region of any country. This is may be due to the presence of the marsh area for the development of the intermediate hosts, the lymnae snail [9]. Climate and environmental conditions, such as the presence of water bodies, pastures, and wetlands are strongly linked with the distribution of *Fasciola* and in turn the disease. These conditions create a favorable environment for the development and transmission of free-living fluke stages and for the growth and reproduction of the intermediate host, the lymnae snail [11].

The transmission of *Fasciola* depends on the availability of an intermediate host, the lymnae snail. Animals ingest metacercaria, up on grazing on the pasture around the marsh area and the worm migrates to the liver where it causes extensive liver damage, and the mature worm inhabits in the bile duct of the liver [12]. *Fasciola* infections are known to cause clinical signs, such as weight loss, sudden death and anemia [13]. Clinical disease is well known; however, sub-clinical infections are often remaining unnoticed, leading to marked economic losses, reduced milk yield, weight loss, reduced fertility, and immunity [14].

The diagnosis of Fasciolosis is based on examination of liver and finding of the adult parasite or presence of its eggs through fecal examination [15]. Small ruminant Fasciolosis is endemic in many parts of Ethiopia with prevalence ranging from 11.5% to 87.0% [16]. However, there is no sufficient and documented data on the prevalence of small ruminants Fasciolosis in Mekelle, northern Ethiopia. Therefore, the objective of this study was to determine the prevalence of small ruminant Fasciolosis in Mekelle, Tigrai Regional State, Northern Ethiopia.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

The study was conducted in Mekelle, located around 783 kilometers North of Ethiopian capital

city, Addis Ababa. The city is located at 39°28'E longitude and 13°29'N latitude situated in the extension of the central highlands of Ethiopia, with an elevation of 2084 meters above sea level. Mekelle is found under climatically "Woina Dega, conditions with an average rainfall and temperature ranges from 600 mm and 17-21ºC, respectively. Its rainy season occurs mainly between June and September, although a short rainy season does occur on March and April [17]. The city has a moisture index ranging in between 0.25 and 0.5, which indicates moderately dry area [18].

2.2 Study Animals

The study animals were 245 sheep and 139 goats which were kept under extensive production system with different age groups, body condition scores, origin, and sex. The origin of sheep and goats were recorded from Ayinalem, Quiha, and Dagia. Age categorization into young (lamb/kid) and adult was determined according to the classification of age group described by [20]. Furthermore, the body condition score was determined according to [21] which grouped as poor, medium, and good.

2.3 Study Design

A cross-sectional study was conducted from November 2017 to March 2018 to determine the prevalence of Fasciolosis in small ruminant at Mekelle, Tigrai Regional State, Northern Ethiopia.

2.4 Sample Size Determination

A simple random sampling method was used to select the study of animals. The sample size determination was based on the expected prevalence of 50% and the absolute desired precision of 5% and a confidence level at 95%. The sample size was calculated as per the method described [22].

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

Where, n = required sample size; 1.96^2 = the value of z at a confidence level; P_{exp} = expected prevalence; d^2= desired absolute precision. Hence, a total of 384 animals were included in this study.

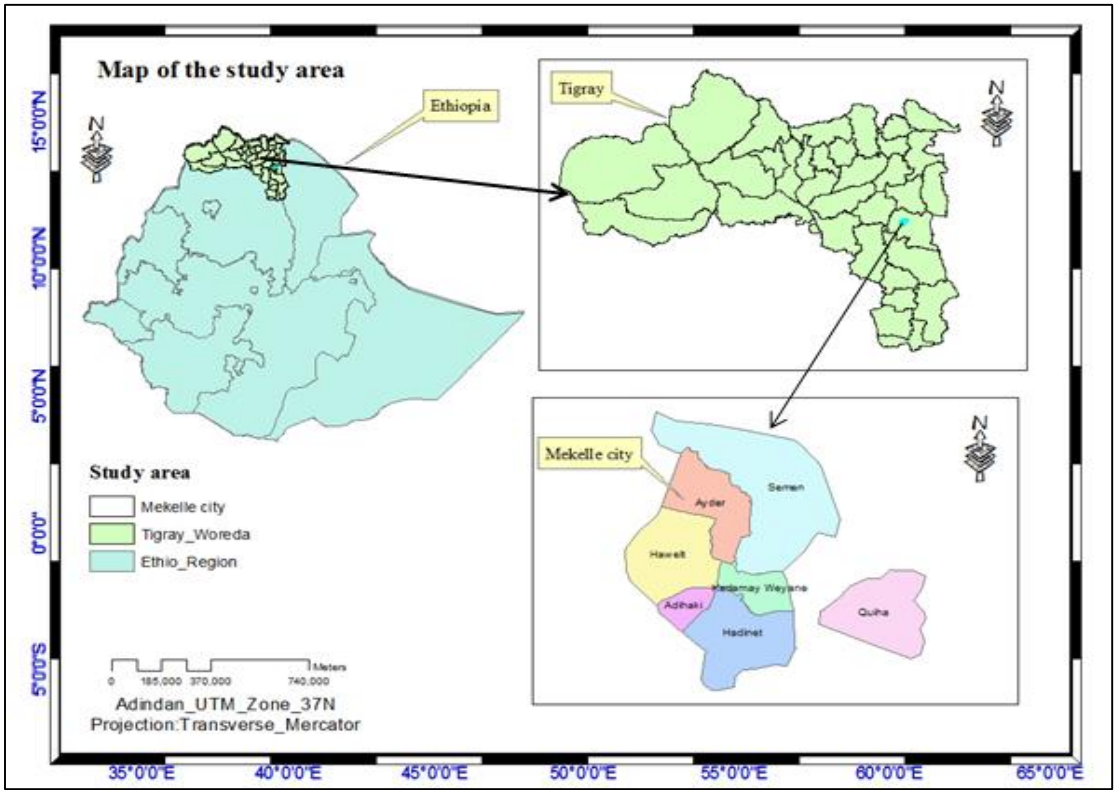

Fig. 1. Mekelle office of urban agriculture, MUA [19]

2.5 Data Collection

A total of 245 sheep and 139 goats were randomly selected and fresh fecal samples were collected from individual animals by using disposable hand glove directly from the rectum of animals. After collection, the fecal samples were transferred to sample bottle and preserved in 10% formalin. Each sample was clearly labeled with species, place of collection (origin), body condition score, sex, and age. Then, the labeled sample was submitted to Mekelle University, College of Veterinary Sciences, Parasitology laboratory. One-half of the samples were stored in the refrigerator at 4ºC for processing of the next day. And rest was examined by using the sedimentation technique immediately [23,24] in order to determine the prevalence of Fasciolosis.

2.6 Data Analysis

All collected data regarding fecal examination was recorded and entered into Microsoft Excel spread sheet. Statistical analysis was conducted using Statistical Package for the Social Science (SPSS) software (version 20.0). The prevalence of *Fasciola* was calculated by dividing the number of sheep and goats having the parasite to the number of sheep and goats examined. Chi-square (χ^2) was used to measure the association between the prevalence of the *Fasciola* with body condition, age, sex, origin and species. Confidence level was held at a 95% with degree of freedom 5% and statistical analysis for the difference in prevalence of *Fasciola* among risk factor were considered significant when the p-value was set at a P<.05.

3. RESULTS

Out of the 384 animals examined, 67 (17.5%) were infected with Fasciolosis. Based on the animal species examined, the prevalence of Fasciolosis in ovine and caprine was statistically significance difference (*P=.00*) and was 24.08% and 5.75%, respectively.

There was no statistical difference (*P=.81*) among the origin of the animals where they came with. The occurrence of the parasite was higher in animals with poor (42.2%) followed by medium (10.1%) and good (9.8%) body condition. Thus, a statistically significant difference (*P=.00*) was observed.

The result showed that no statistically significant difference (*P=.19*) was found as regards to the occurrence of Fasciolosis between male and female animals. The occurrence of Fasciolosis was slightly higher, but not statically significant *(P=.92)* in adult (17.4%) as compared to young (17.6%) animals.

4. DISCUSSION

The prevalence observed in the present study was comparable to that reported by [25] in Addis Ababa abattoir enterprise with the overall prevalence of 18.8% in small ruminants where 25.9% and 10.6%, in sheep and goats, respectively. The study in the region of Azad Jammu also revealed that prevalence of 17.9% in small ruminants where 26.49% and 9.9% in sheep and goats [26]. In the present study result

Table 1. Prevalence of Fasciolosis based on animal species

Species	Number examined	Number affected	Prevalence (%)	P-value
Ovine	245	59	24.1	*P=0.00*
Caprine	139	8	5.8	
Total	384	67	17.5	

Table 2. Prevalence of Fasciolosis based on animal origins and body condition

Origin	Number examined	Number affected	Prevalence (%)	P-value
Ayinalem	193	33	17.1	*P=.81*
Dagia	91	18	19.8	
Quiha	100	16	16	
Total	384	67	17.5	
Body condition	**Number examined**	**Number affected**	**Prevalence (%)**	**P-value**
Poor	83	35	42.2%	*P=.00*
Medium	199	22	10.1%	
Good	102	10	9.8%	
Total	384	67	17.5	

Table 3. Prevalence of fasciolosis based on the sex and age groups

Sex	Number examined	Number affected	Prevalence (%)	P-value
Female	248	41	16.5	*P=.19*
Male	136	26	19.1	
Total	384	67	17.5	
Age	**Number examined**	**Number affected**	**Prevalence (%)**	**P-value**
Young	142	25	17.6	*P=.92*
Adult	242	42	17.4	
Total	384	67	17.5	

was higher than that of previous studies [27] who reported an overall prevalence of Fasciolosis 11.6% with 14.6% in sheep and 8.8% in goats in and around Hirna woredas. Moreover, overall prevalence of Fasciolosis of 13.88% in small ruminants with 23.26% and 4.12% prevalence in sheep and goats in Haramaya District, Eastern Ethiopia was reported [28].

The difference in the prevalence of *Fasciola* species may be due to the differences in the presence of favorable environments for the availability of the intermediate host snails, where the study animals had originated from. Climate conditions, particularly rainfall, were frequently associated with difference in the prevalence of *Fasciola* species infection. Marshy areas are suitable for intermediate hosts like snails to reproduce and to survive longer periods under moist conditions. These snails require neutral soil which remains moist throughout the year and tends to do better in areas with moderate winters which allow the eggs and immature stages to survive [8].

Factors like host, animal management, and malnourishment, immune suppression of the host, improper sanitation, and ignorance of animal health problems contribute greatly for the growth of parasites and its vectors development and transmission in the environment. The differences might also be due to the use of anthelmintic against *Fasciola* in the study areas. Generally, the variation of this infection in these areas might be due to the variation in agro-ecological condition, geographical variation, number of study samples and climatic conditions of the areas [29].

In the present study, significantly higher Fasciolosis was detected in sheep (24.1%) as compared to goats (5.8%). This result agrees with the former finding by [25] who reported 25.9% and 10.6% Fasciolosis prevalence in sheep and goats, respectively. A similar finding was previously recorded in Haramaya district, Eastern Ethiopia [28]. The variation in the prevalence of Fasciolosis between species might be due to the fact that sheep had unselective type of grazing behavior which led to a high chance of acquiring the infection, whereas goats were selective grazers or browsers and did not graze on marshy areas where there was a high chance of picking the metacercaria along with the grass. Goats also graze on leaves and branches on bushes and trees but sheep graze on plants that are on the ground where metacercaria are mostly found. So, the possibility of infection with metacercaria is higher in sheep than goats [30].

There was also considerable significant variation regarding body conditions. The disease was higher in poor body conditions followed by medium and good body conditions. The result was in agreement with obtained findings from different parts of Ethiopia [31,32,33] from different part of Ethiopia. Obviously, this could be due to the fact that animals with poor body condition are usually less resistant and are consequently susceptible to infectious diseases. In the other way, the presence of high prevalence of Fasciolosis in animals with poor body condition may be due to the effect of the parasite in the animal as *Fasciola* species are blood and tissue fluid suckers and even damage the parenchyma of the liver (immature *Fasciola*) and causes bleeding, while the adult parasites are in the bile duct, which ultimately decrease proteins from the host which leads to poor body condition [34].

The significant variation in the prevalence of Fasciolosis in relation to body condition could be further justified by the fact that cholangitis and liver cirrhosis induced in chronic Fasciolosis could reduce bile flow to the duodenum and hence reduced lipid emulsification, digestion and absorption of fatty acid and lipid-soluble vitamins [35]. This finding confirmed the importance of Fasciolosis in causing weight loss and emaciation as a characteristic sign of the disease [36].

The sex of sheep and goats has no effect on the prevalence of Fasciolosis. These animals expose to graze and parasitic infection with equal rate and move in searching for food and water together, thus exposing to the same risk of infection. In a study from Iran, [37] reported no sex- related difference in the prevalence of Fasciolosis in sheep and goats. Non-significant differences were also reported from Ethiopia for the sex of sheep [38]. Further, another author [39] has also suggested that Fasciolosis equally affect both sexes.

The result of the present study showed no significant difference as related to the origins of the animals (*P=.81*). This might be due to the similarity of agro-ecological and climatic conditions of the area, such as rainfall and temperature. Based on the result obtained from the study, the occurrence of Fasciolosis was slightly higher in adult as compared to young animals. Even though there was difference between the two-age group, but there was no statically significant difference between them (*P=.92*).

5. CONCLUSION AND RECOMMENDATIONS

The finding of the current study showed that Fasciolosis is an important disease with high prevalence in the study areas. Apart from the many factors, animal level factors like age, body condition and animal species are also associated with the occurrences of the infection. Based on the above conclusions, the following recommendations are forwarded:

- Animal should be kept in high level of nutrition especially those with poor body condition and young's so as to develop immunity against *Fasciola*.
- Strategic anthelminthic treatment with appropriate flukicidal drugs should be practiced to control the load of the parasites.
- An appropriate control and prevention methods of *Fasciola* should be designed like: avoiding the intermediate host and preventing the animals from grazing at infected pasture.

ETHICAL APPROVAL

As per international standard, ethical approval has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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