Prevalence of Bovine Fasciolosis and its Associated Risk Factor in Mecha District, West Gojam Zone, Northwestern Ethiopia

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Abstract: A cross-sectional study was conducted to determine the prevalence and risk factors of bovine fasciolosis in Mecha district, West Gojam zone, Northwestern Ethiopia from October, 2013 to April, 2014. The study was based on coprological examination using sedimentation technique on fecal samples collected directly from the rectum of individual animals. Out of 384 coprologically examined cattle, 121 (31.5%) animals were found positive for Fasciola eggs. The prevalence rate of fasciolosis in adult cattle (35.7%) was higher than in young cattle (22.3%) and the difference was statistically significant (P<0.05). However, there was no significant difference (P>0.05) between the two sex groups with prevalence of 29.9% and 32.7% in male and female, respectively. The prevalence of fasciolosis in the present study was statistically significant (p<0.05) with body condition. The highest prevalence were reported in cattle with poor body condition (37.3%) followed by good body condition (23.3%). The prevalence as determined from coprological examination was highest in Enamirt (38.4%) followed by Eniguti (27.8%) and Enachenifalen (26.8%) peasant associations (PAs). The difference in the prevalence in the three PAs was not statistically significant (p>0.05). The result of the study indicated that season had significant difference (P < 0.05) with prevalence of (36.7%) in animals that were examined during wet season and (24.5%) in animals that were examined during dry season. In general, fasciolosis could be considered as a major problem in Mecha district as the ecological factors, management conditions and the presence of Koga dam in the study area are suitable for both the snail intermediate host and the parasite to be maintained. Therefore, control strategies targeted on the parasite and the intermediate hosts as well as implementation of appropriate grazing management in the study area are warranted.

Key words: Bovine • Coprology • Fasciolosis • Mecha district • Prevalence

INTRODUCTION

Ethiopia has extremely diverse topography, a wide range of climatic features and multitude of agro-ecological zones, which make the country favorable for different agricultural systems. This intern contributed to the existence of large diversity of farm animal genetic resource in the country [1].

The diverse ecology in Ethiopia makes Ethiopia home for large population of different domestic and wild animals with considerable distribution to the national economy. So with these great variation in climate and topography, Ethiopia, possess large number of livestock population in Africa and estimated at 49 million cattle, 23 million sheep, 18 million goats, 1 million camels, 7 million equines, 53 million poultry and 10 million bee colonies [2].

Livestock diseases are widely distributed and one of the major causes of livestock mortality and sub-optimal productivity in all agro-ecological zones of the country, diminishing the benefit of their high productivity performance, is attributed to helminthes infection in Ethiopia and fasciolosis is a major factor in this respect [3].

Fasciolosis is helminthiasis caused by Fasciola hepatica and Fasciola gigantica [4]. They are trematodes that live in the bile ducts of domestic and wild herbivores and occasionally infect man [5].

Although most mammals are susceptible, infection is highest in cattle and sheep. Most infections occur by grazing in and around water in fluctuating habitats that stay wet for more than half the year [1]. Small streams, ponds and marshy areas are obvious snail breeding areas,
but any depression such as hoof prints can hold a bit of infection [6].

In Ethiopia the prevalence of bovine fasciolosis has shown to range from 11.5%-87% [7]. *F. hepatica* was the most important fluke species in Ethiopia livestock with distribution over three quarter of the nation except in the arid Northeast and East of the country. The distribution of *F. gigantica* was mainly localized in the Western humid zone of the country that encompasses approximately one fourth of the nations [8].

Among the snail intermediate hosts of trematodes, the genus *Lymnaea* is of importance in the transmission of liver flukes. *Lymnaea species* may either aquatic or amphibious. When encysted metacercariae are ingested by bovine with herbage, they excyst in small intestine, penetrate the wall and migrate through the hepatic parenchyma before entering the bile ducts and developing to a reproductively capable adult [1]. Individual adult flukes will attach at various sites to the walls of the bile ducts and feed on blood. The multi-site feeding pattern in combination with the irritation from the spines on the fluke’s cuticle irritate the bile ducts, which cause thickening of the bile duct walls and impairment of liver function [9].

The disease syndromes caused by liver flukes are acute and chronic fluke diseases [1]. Acute fluke disease occurs during initial invasion of the liver by large populations of migrating immature flukes. Chronic disease is caused by the adult flukes in the bile ducts. It is the most common form of the disease in cattle [10].

Diagnosis of fluke infections based primarily on a combination of clinical signs, detection of fluke eggs or adult forms, previous history of fasciolosis on the farm and identification of snail habitat [11].

Fasciolosis is the disease of great economic importance in many countries. The presence of one fluke leads to condemnation of the liver in slaughtering establishments. The disease is responsible for considerable economic losses in the cattle industry, mainly through mortality, liver condemnation, reduced production of meat, milk and wool and expenditures for anthelmintics. The world-wide losses in animal productivity due to fasciolosis were estimated at USD 200 million per annum, to rural agricultural communities and commercial producers, with over 600 million animals infected [4]. Eventhough the prevalence of bovine fasciolosis were investigated in different parts of Ethiopia; yet there is no research conducted that shows the prevalence of bovine fasciolosis and its associated risk factors in Mecha Woreda.

Therefore the objectives of this study were:

- To determine the prevalence of bovine fasciolosis in the study area.
- To assess the risk factors of bovine fasciolosis in Mecha district.

**MATERIAL AND METHODS**

**Study Area Description:** A study was conducted in three peasant associations (PAS) in Mecha district of West Gojam zone in Amhara Regional State, North West Ethiopia located about 525 km North West of Addis Ababa and 34 km South East of Bahir Dar the capital city of Amhara region. In Mecha district the climatic condition alternate between along summer rain fall and winter dry season with mean annual rain fall of 1200-2000 ml. The mean temperature is between 24-27 °C and altitude ranges from 1800 to 2500 m.a.s.l. The study area is located at latitude 10°30’ N and longitude 37°29’ E. The land is covered by different vegetation types such as Savanna grass land and bush lands. Agriculture is the main economic sector in the study area. The main agricultural activities currently practiced include irrigation (Modern and traditional) and mixed farming. The major agricultural products seasonally harvested include sorghum, maize, teff, wheat and other legume groups. In this district there are 192, 556 cattle, 148 971 ovine, 23, 106 equine and 204, 181 poultry [12].

**Study Population:** The study was carried out on indigenous cattle of all age groups of both sexes in three selected PAs. During the study period, cattle of all age and sex groups were randomly selected for fecal examination. All these animals were privately owned by small holder farmers and managed under traditional extensive system.

**Study Design:** A cross sectional study was undertaken to determine the prevalence and risk factors of bovine fasciolosis based on coprological examination of cattle found in the selected peasants starting from October, 2013-April, 2014.

**Laboratory Technique:** In the laboratory coproscopic examination was performed to detect the presence of *Fasciola* eggs using the standard sedimentation techniques used by Hanson and Perry [13].
Coprological Examination: Fresh fecal samples for parasitological examination were collected directly from the rectum of each animal, using disposable plastic gloves and placed in clean screw capped universal bottles. Each sample was labeled with date of submission, age, sex, season, body condition and place of origin. Samples were preserved with 10% formalin solution to avoid the eggs development and hatching.

Sampling and Sample Size Determination: Since there was no previous survey conducted in the study area the sample size was determined based on the expected prevalence rate of 50% and absolute desired precision of 5% at confidence level of 95% and the sample size was determined to be 384 based on formula given by Nicholson and Butterworth [14], which is given below

\[ n = \frac{1.96^2 \times P_{exp} (1 - P_{exp})}{d^2} \]

Where:
- \( n \) = required sample size
- \( P_{exp} \) = expected prevalence of Bovine Fasciolosis (50%)
- \( d \) = desired absolute precision level at 95% confidence interval

Simple random sampling technique was used to select animals from the herd. Body condition for each cattle was estimated based on Nicholson et al., [15] as poor and good. The age of the animals was group as young (between 1 and 3 years) and adults (greater than or equal to 3 years) according to the classification used by Bitew et al. [16].

Data Analysis: All raw data that were recorded from this study were entered into Microsoft Excel database system and referenced with geographical locations of the study sites. Using SPSS version 20 computer program, data were summarized and analyzed. Chi square test was used to determine in infection rate of fasciolosis between risk factors. A 5% significant level was used to determine whether there were significant differences between the parameters measured.

RESULTS

Overall Prevalence: From a total of 384 faecal samples examined from cattle during the study period, 121 (31.5%) samples were found positive for fasciolosis. The prevalence of fasciolosis recorded in the three Peasant Associations (PAs) were 38.4%, 27.8% and 26.8% in Enamirt, Eniguti and Enachenifalen, respectively. This difference in the prevalence was not statistically significant (p>0.05) (Table 1).

Prevalence by Body Condition Scores: In the present study the prevalence of fasciolosis was found to be higher in cattle with poor body condition than those with good body condition ones with prevalence of 37.3% and 23.3% respectively. The difference in the prevalence in the two categories in body condition score was statistically significant (p<0.05) (Table 2).

Prevalence by Age Groups: From the result of the present study on the prevalence of bovine fasciolosis between different age groups showed an inverse correlation with

<table>
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<th>Table 1: Prevalence of bovine fasciolosis based on Location</th>
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<tr>
<td>Location</td>
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<tr>
<td>Enairt</td>
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<td>Enachenifalen</td>
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<td>Total</td>
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<th>Table 2: Prevalence of bovine fasciolosis based on Body Condition Scores</th>
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<td>Body condition</td>
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<td>Total</td>
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<th>Table 3: Prevalence of bovine fasciolosis based on Age</th>
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<td>Age</td>
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<tr>
<td>Young</td>
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<td>Adult</td>
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<td>Total</td>
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Table 4: Prevalence of bovine Fasciolosis based on Sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>Sample size</th>
<th>Positive</th>
<th>Prevalence (%)</th>
<th>X²(P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>167</td>
<td>50</td>
<td>29.9</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>217</td>
<td>71</td>
<td>32.7</td>
<td>0.338(0.561)</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>121</td>
<td>31.5</td>
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Table 5: Prevalence of bovine fasciolosis based on Season

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<thead>
<tr>
<th>Season</th>
<th>Sample size</th>
<th>Positive</th>
<th>Prevalence (%)</th>
<th>X²(P-value)</th>
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<tbody>
<tr>
<td>Wet</td>
<td>221</td>
<td>81</td>
<td>36.7</td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td>163</td>
<td>40</td>
<td>24.5</td>
<td>6.376(0.012)</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>121</td>
<td>31.5</td>
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prevalence of 22.3% and 35.7% in young and adult cattle, respectively. The difference in the prevalence in the two categories in age was statistically significant (p<0.05) (Table 3).

**Prevalence by Sex Groups:** The prevalence of fasciolosis in male and female cattle was 29.9% and 32.7%, respectively. Although the prevalence was relatively higher in female cattle the difference was not statistically significant (p>0.05) (Table 4).

**Prevalence by Season:** In the present study the prevalence of fasciolosis was found to be higher in cattle examined during wet season than those examined during dry season ones with an overall prevalence of 36.7% and 24.5%, respectively. The difference in the prevalence in the two categories in season was statistically significant (p<0.05) (Table 5).

**DISCUSSION**

The present study revealed an overall prevalence of fasciolosis, 31.5% in the study area. This finding was in agreement with when compared with the prevalence (34%) reported by Rahmeto [17] in Woliso, (28.63%) by Mulugeta [18] at Hawassa. But it was lower than (87%) reported by Dagne [19] at Debrebrehan, (83.88%) [20] at Gondar and Yehenew [21] at Gondar and relatively higher than the 4.9%, 12.4% and 19.5% recorded in Soddo [22], in Kombolcha [23] and in Gondar [24] municipal abattoirs and ELFORA, respectively. This great variability shown was probably due to the techniques used for sample collection, storage and processing of faecal materials [24], the ecological and climatic differences between different locations throughout the country and management system of animals. One of the most important factors that influenced the occurrence of fasciolosis in an area was availability of the suitable snail habitat [11, 25].

This study also revealed that there was no significant difference (P>0.05) among the different localities (PAs) with respect to the prevalence of Fasciola eggs which was 38.4%, 27.8% and 26.8% in Enamirt, Eniguti and Enachenifalen, respectively. This could be attributed to the presence of large marshy and/or water logged areas, similarity of agro-ecological conditions such as altitude, rainfall and temperature and the presence of Koga dam irrigation in the three PAs favoring the development of intermediate hosts and the parasite stages.

Analysis of the fecal egg detection result didn’t show statistically significant difference between two sexes as risk factor (P>0.05). Similar results that supported the present finding were reported by Rahmeto [17], Mulualem [20], Abdu [26] and Solomon and Abebe [27]. This might be due to common exposure to a similar Fasciola contaminated pasture land by both sex groups and traditionally animals were driven to pasture regardless of sex. On the contrary, Block and Arthur [28] revealed a higher prevalence in male than female. This was probably related to the management system with longer exposure of male outdoor while females were kept in door during pregnancy and lactation.

In the current study, a significant variation (P<0.05) was revealed in the prevalence of Fasciola between different age groups. This finding well agreed with the works of Solomon and Abebe [27], Yilma and Mesfin [29] and Fikiretemariam et al. [30]. The detections of Fasciola eggs were lower (22.3%) in the young group (between 1 and 3 years age). This was attributed to the fact that young were not often driven with adult age groups to grazing and watering points. They were kept at a nearby village where the source of feeding was much limited. This practice naturally reduced the chance of exposure in this age class. In different parts of Ethiopia, similar results indicating inverse correlation of prevalence and age of cattle were reported by Rahmeto[17]. As the age increased to the adult stage, that was second group (=3years), the
magnitude of infection rate increased to a higher level (35.7%). The likely explanation to this condition was that the more the age of the young increased, the possibility of moving towards new environment occurred, which was an exposure to Fasciola contaminated pasture lands and water points, that was as the age of the animal increased, the possibility of being exposed to Fasciola increased and hence high prevalence of fasciolosis was observed. On the contrary, different works reported opposite finding with the present work and clearly justified that the decrease in infection rate (prevalence) as age increase was the result of acquired immunity which was manifested by humeral respond and tissue reaction in bovine liver due to previous challenge [19,31]. They also reported that the increase resistance (Low prevalence) as age increase was most likely related to the high level of tissue reaction seen in bovine liver, server fibrosis which impeded the passage of immature fluke, acquired resistance, thickening, stenosis and calcification of bile ducts, assumed unfavorable site for adult parasites and consequently fasten their explosion.

In this study, a significant variation (P<0.05) was revealed in the prevalence of Fasciola between different body condition scores. Poor body conditioned cattle (37.3%) was highly vulnerable to or infected by Fasciola parasite, whereas in good body conditioned cattle (23.3%) prevalence was low. In support of this finding, a study conducted in Mekelle [32] and at Adwa Municipal Abattoir [33]. Obviously, this could be due to the fact that animals with poor body condition were less resistant and were consequently susceptible to infectious diseases as a result of malnutrition. These results proved that as the weight of the animal increased the parasitic infection decreased. This could be due to acquired immunity in the host. The present finding not agreed with the works of Solomon and Solomon and Abebe [27], Fikirtemariam et al. [30] and Shiferaw et al. [32]. They said body condition deterioration in cattle was manifested when fasciolosis reached its chronic stage even though there was a difference in infection rate between poor and good body conditions.

The monthly/seasonal variation in the prevalence of fasciolosis had been studied for 6 months (October, November, December, January, February and March) which was grouped as wet and dry in the study area. In this study high infection rate (36.7%) was encountered in October, November and December (Wet) while lower infection (24.5%) in January, February and March (Dry) having statistical significant difference (p<0.05). This finding agreed with the works of Tadele and Worku [8] and Wakuma [34] reported wet season was when the highest ecological conditions still prevailed. This could be associated with bionomic requirements for breeding of the Lymnaea snails and development of the intramolascan stages of the flukes often reach the optimum threshold during the wet months of the year and during the dry periods, breeding of the snails and development of the larval flukes slow down or stops completely and snails undergo a state of aestivation [35].

CONCLUSION

The present study conducted on bovine fasciolosis in Mecha Woreda indicated that fasciolosis was the most widespread and prevalent parasitic disease affecting the health and productivity of animal with an overall prevalence of 31.5%. The present study revealed a higher prevalence of bovine fasciolosis indicating that it is an important disease that could potentially hinder the productivity of cattle in the study area and tremendously affect the rural economy at large. In general, fasciolosis is one of major problem for livestock development in the study area by inflicting direct economic losses and its occurrence is closely linked to the presence of biotypes suitable to the development of snail intermediate host. From the above conclusion, the following recommendations are forwarded:

- Strategic anthelmintic treatment with appropriate fluckcidal drugs should be practiced to eliminate the fluke burden of the host of the animal and minimize the pasture contamination by faecal egg shedding, thus interrupting the life cycle.
- Reduction in the risk of infection by planned grazing management especially during high outbreak months by the application of zero grazing (Cut and carry).
- Further studies on epidemiology of fasciolosis of bovine should be conducted on the study area.
- Finally the farmer should be well educated and informed about importance of the disease control programmes and good management system.

REFERENCES


