Prevalence of Bovine Fasciolosis and its Economic Significance at Adama Municipal Abattoir, East Shoa, Central Ethiopia

Semu Mersha, Elias Gezahegn and Geru Lolo

Hetosa District Livestock and Fisheries Development Office, Iteya, Ethiopia
Bale Zone Pastoral Area Development Office, Robe, Ethiopia
Yabelo Regional Veterinary Laboratory, Yabelo, Ethiopia

Abstract: A cross sectional study was conducted to determine the prevalence and the financial loss due to bovine Fasciolosis at Adama municipal abattoir from November, 2009 to March, 2010 by using postmortem examination of liver of slaughtered cattle and secondary data collection. The objectives of the study were to determine the overall prevalence and financial loss due to bovine Fasciolosis in the study abattoir and determine the most prevalent species of liver fluke in indigenous adult cattle slaughtered in the abattoir. From the total of 750 cattle slaughtered during the study period, 157 (20.9%) were found to be positive for Fasciolosis. Fasciola hepatica was found to be the most prevalent liver fluke species affecting cattle slaughtered in the study abattoir which was infected 102 (64.97%) of the total livers found to be positive for bovine Fasciolosis whereas F. gigantica and mixed infection forms of Fasciolosis recovered were 40 (25.48%) and 15 (9.55%) respectively. Infection forms of Fasciolosis were statistically analyzed on the basis of body condition to assess the impact of the disease within animals and among animals with different body condition scores. The result indicated that Fasciolosis infection has a statistically significant difference (P<0.05) in relation to body condition. In line to the financial importance of bovine Fasciolosis in the study abattoir, the loss incurred due to liver condemnation average is 1,950 and 148,755.75 Ethiopian birr per day and annually respectively. The result of this study indicated that Fasciolosis is an economically important disease causing a direct and indirect financial loss in the study area. Further researches should be conducted on the epidemiology of the disease, biology and ecology of intermediate host snails in order to foster planning and implementation of suitable prevention and control strategies.

Key words: Bovine · Adama · Prevalence · Financial Importance · Fasciola hepatica

INTRODUCTION

Ethiopia lies the tropical altitudes of Africa and has an extremely diverse topography a wide range of climate features and altitude of agro-economic zones which makes the country suitable for agricultural production systems. This inters has contributed to the existence of large diversity of farm animals genetic resource in the country [1].

Despite the large livestock population of Ethiopia, the economic benefits remain marginal due to prevailing disease, poor nutrition, poor animal production system, reproductive efficiency management constraints and general lack of veterinary care. Endo-parasites are responsible for the death of one third of calves, lambs and kids and considerable losses parts of carcass condemned during meat inspection [2].

Bovine Fasciolosis is economically important parasitic disease of cattle caused by Fasciolidae trematode of the genus Fasciola, establish and develop in the bile ducts. The two most important Fasciola species are Fasciola hepatica found in the temperature and cooler areas of high altitude in the tropics and subtropics, Fasciola gigantica which predominates in the tropical areas. The geographical distribution of trematode species is dependent on the distribution of intermediate host species of snails [3].
In Ethiopia the presence of both *Lymnaea truncatula* and *Lymnaea natalensis* have been reported [4]. *L. truncatula* is an amphibious snail living in shallow pods, wet lands and water troughs while *L. natalensis* is a true mollusk which lives in immersed clear and slow flowing rivers [5] both species are absent from temporary pools and water courses that disappear in dry season [6]. Areas which seasonally flooded pasture, grazing areas of lake shores, slowly flowing water ways and banks of rivers are among the conducive environment for breeding of snails of vectors of Fasciolosis [7].

The snail for *F. hepatica* is *L. truncatula* which is amphibious snail whereas snail for *F. gigantica* is *Lymnaea natalensis* which is aquatic snails. The optimum temperature for development of snail is 15-26°C and development and reproductive activity take place at temperature bellow 10°C [8].

In our country, *F. hepatica* is a wide spread in areas with altitudes of 1800-2000 meters above sea level while *F. gigantica* appears to be the most common species in areas bellow 1200 meters above sea level. Both species co-exist in areas which altitude ranging between 1200-1800 meters above sea level [9]. Fasciolosis occurred commonly as chronic disease in cattle and the severity often depend on the nutritional status of the host [9]. Among many parasitic diseases of domestic animals, Fasciolosis is known to be one of the most important parasitic problems that affect production in ruminant. Infection is the highest in cattle and sheep [3]. It is responsible for the wide spread morbidity and mortality especially in cattle and sheep characterized by weight loss, anemia and hypo-proteinaemia. It has also expressed in terms of liver condemnation at slaughter house [10].

The control Fasciolosis is achieved through a combination of control of snail intermediate host and treatment of infected cattle [11]. However because of extreme efficiency of this parasite and the way in which it takes advantage of environmental conditions to multiply enormously, careful study of its ecology is necessary to predict periods of danger and initiate strategic attacks on both snails and flukes [12]. Improvement in current farm management can reduce the chance of infection by limiting the contact between intermediate and final host direct action of eliminating intermediate host population. The use of one or more of these measures in an integrated strategy should be based on sound economic assessment of the relative control options [13].

Therefore the main objectives of this study were:

- To assess the prevalence of Fasciolosis in cattle slaughtered at Adama municipality abattoir.
- To identify the financial loss due to direct (liver condemnation) and indirect losses (carcass weight reduction) due to Fasciolosis.
- To identify commonly involved fluke species in the study area.

**MATERIALS AND METHODS**

**Study Area:** The study was conducted at Adama municipal abattoir from November, 2009 to March, 2010 in Adama town, Eastern Shoa Zone of Oromia regional state, central Ethiopia. The town is located at 95 km south east of Addis Ababa at 39.17°N and 8.33°E with altitude of 1622 meters above sea level. It is situated in the well-known East Africa rift valley. Adama has annual rainfall and temperature ranging from 400 mm to 800 mm and 13.9°C. respectively. The town is one of the most populous among towns of the range regional states and is situated at an important multidirectional trade route [14].

Major livestock reared in Adama town and its surrounding includes cattle, sheep, goats, equine and poultry. The farming system around the town is mixed crop and animal agriculture according to district agriculture office the total livestock populations on the basis of species are 70, 622 cattle, 360142 sheep, 420968 goats, 31903 equines, 42 camels and 193, 755 poultry [14].

There are feed lots supplying beef cattle to surrounding slaughter houses and occasionally to export to Middle East countries. As a result animals from different part of the country. Including Arsi, Bale, Afar, Harar and Borena are driven to Adama town. The town has one municipal abattoir that supplies inspected meat to more than 150, 000 in habitants and has about 61 legally registered butchers. Backyard slaughter is also significant in spite of pressure from the government authority to ban this activity.

**Study Animals:** The study was performed on local, adult indigenous cattle which were presented for slaughter from different localities in the eastern part of Ethiopia to Adama municipality abattoir. Cattle slaughtered in the abattoir were brought from different markets, which intern was coming from different livestock market in the vicinity. Animals were categorized based on their body conditions following the methods described by Nicholsen and Butterworth [15].
Study Design: A cross sectional type of study was used to determine the prevalence and financial significance of bovine Fasciolosis using postmortem examination of livers from slaughtered animals and secondary data analysis. During the study period the liver of each sampled slaughtered animal was carefully examined by visualization and palpation of the entire organ followed by transverse incision of the thin left lobe in order to expose liver flukes for confirmation [3]. Species identification of the recorded *Fasciola* was performed based on morphological features of the agent and classified into *F. hepatica* and *F. gigantica* and mixed form of liver fluke infection [8].

Sample Size Determination and Sampling Methodology: A single random sampling was done at the abattoir on cattle presented for slaughter. Thus taking 49% expected prevalence that was reported by yilma [17] in Debre zeit, that sample size used for present study was calculated according to the method described by Thursfield [16] as follows.

\[
N = \frac{1.96\text{exp}(1-p\text{exp})}{d^2}
\]

where \(N\) = sample size
\(P_{\text{exp}}\) = expected prevalence
\(d\) = desired absolute precision

There for at 95% confidence interval 5% absolute precision and 49% expected prevalence a total of 384 sample ware taken. But to increase precision, that total numbers of animal included in the present study were 750.

Study Methodology
Abattoir Survey: Abattoir survey was conducted based on a cross sectional study during routine meaty inspection on randomly selected cattle slaughtered at Adama municipal abattoir. A total of 750 cattle were examined from November 2009 to March 2010 for determining the prevalence of Fasciolosis. During ante mortem examination, records about species, breed sex origins of the animal were kept (annex 1). Body condition score was also recorded (annex 2). During post mortem inspection each liver inspected, palpated and incised based on routine meat inspection procedures [17]. All liver having Fasciola species were registered and flukes were collected for species identification. Characterization of liver lesion was done at light moderate and severe described by Ogurinade [18] as indicate in the annex 3.

Species Identification: After making systematic incision on the liver parenchyma and the bile ducts, flukes were collected in universal bottle containing 10% formalin preservative and then examined to identify the involved fluke species. *Fasciola. gigantica* is 20-754 mm x 3.12 mm in size whereas *F. hepatica* is 20-30 mm x 10 mm in size but readily recognized by its larger size. The anterior cone smaller than that of *F. hepatica*, the shoulders are not prominent and body is not transparent. It is grayish brown in color which is changed to grey when preserved [8].

Financial Loss Assessment: Direct financial loss resulted from condemnation of liver affected by Fasciolosis. All livers affected with Fasciolosis were totally condemned. The annual loss from liver condemnation was assessed by considering the overall prevalence of the disease, the total annually slaughtered animals in the abattoir and retail market price of an average liver. Annual slaughter rate was estimated from retrospective abattoir records of the last 3 years, while retail market price of an average sized Zebu liver was determined from the information collected from butcheries in Adama town. The information obtained was subjected to mathematical computation using the formula stated by Ogunirade et al. [18].

\[
\text{ALC} = \text{CST} \times \text{LC} \times P
\]

where
\(\text{ALC}\) = Annual loss from liver condemnation
\(\text{CRS}\) = Mean annual cattle slaughtered rate at Adama municipal abattoir
\(\text{LC}\) = Mean cost one liver in Adama town
\(P\) = Prevalence of the disease at the study abattoir.

Indirect financial loss was associated with carcass weight reduction due to Fasciolosis. A 10% carcass weight loss due to Fasciolosis in cattle was reported by Robertson (1976). Average carcass weight of an Ethiopian Zebu was taken as 126 kg [21]. Annual financial loss as a result of carcass weight reduction due to bovine Fasciolosis assessed using the following formula stated by Ogunirade et al. [18].

\[
\text{ACW} = \text{CSR} \times \text{BC} \times \text{CL} \times P \times 126 \text{kg}
\]

where
\(\text{ACW}\) = Annual loss from carcass weight reduction.
\(\text{CSR}\) = means annual cattle slaughtered rate as Adama municipal abattoir.
\[ P = \text{prevalence of the disease at the study abattoir} \]
\[ BC = \text{Average price of 1kg beef at Adama town} \]
\[ 126kg = \text{Average carcass weight of Ethiopian Zebu.} \]

**Data Management and Analysis:** The data collected from the study abattoir was recorded in the format developed for this purpose. The data was stored in the Microsoft Excel 2007 program of the computer and analyzed using SPSS (version 17.0) statistical package. Overall prevalence of Fasciola infection on the basis of the condition and species of Fasciola involved was computed. The Pearson chi square \((x^2)\) test was used to determine the significance of variation in prevalence of Fasciolosis among different body condition scores. A 95\% confidence interval and 5\% significant error level was used to determine the presence of significant differences in the parameters measured between different groups.

**RESULTS**

During the study period almost all animals that were slaughtered in the study abattoir were male adult and local breeds. Sex, breed, age factors were not considered in any of the data analysis.

**Over all Prevalence of Fasciolosis:** The study conducted from November 2009 to March 2010 at Adama municipal abattoir the over all prevalence was 20.9\% (Table 1).

**Species Identification:** From the total of 157 affected livers, *F. hepatica* was the most commonly encountered Fasciola species with a prevalence of 64.97\% (102 livers) followed by *F. gigantica* which accounts a prevalence of 25.48\% (40 livers) and prevalence of mixed infection by both species (*F. hepatica* and *F. gigantica*) was found to be 9.55\% (15 livers) (Table 2).

As shown in Table 2 *F. hepatica* was found to be the commonly encountered Fasciola species with a prevalence of 13.6\% (102 livers) whereas *F. gigantica* and mixed form of liver infection account a prevalence of 5.3\% (40 livers) and 20.0\% (15 livers) respectively.

**Pathological Lesions:** Out of the 157 positive livers examined for Fasciolosis 88 (55.1\%) livers were found moderately affected, 57 (36.3\%) livers lightly affected and 12 (7.6\%) livers, which were severely affected and all were condemned due to Fasciolosis.

**Prevalence of Fasciola Species in Animals with Different Body Conditions:** Fasciola infection on the basis of body condition score which was graded as good medium and poor body condition was analyzed (Table 3).

According to the result in Table 3 out of the 37 animals graded as having poor body condition 22 (59.46\%) were positive for Fasciolosis and 189 animals graded as medium body condition 96 (50.79\%) were positive for the disease, whereas out of 524 animals graded as having good body condition, 39 (7.44\%) were positive of the disease. When the overall prevalence of Fasciola infection was seen out of the total 20.9\% Fasciola infection the highest prevalence (12.8\%) was observed in animals with medium body condition score, followed by those having good body condition score with a prevalence of 5.2\% and finally the least (2.9\%) was observed in animals with poor body condition score. The result of the present study indicated that the prevalence of Fasciola infection has significant difference \((P<0.05)\) among animals with different body conditions (table 3).

**Financial Loss Analysis:** The direct financial loss resulted from liver condemnation due to Fasciolosis. Generally all infected livers with Fasciolosis are unfit for human consumption. In the study abattoir 157 livers were condemned as a result of the disease corresponding to an estimated loss (direct loss) about 4710.00 Ethiopian birr from 750 cattle inspected. The average annual cattle slaughtered rate was estimated to be 23,725 while mean retail price of bovine liver in Adama town was 30.00 EB and prevalence of Fasciolosis in Adama municipal abattoir was found to be 20\%. Therefore the estimate annual loss from organ (liver) condemnation is calculated according to the formula given by Oguirnade et al. [18].

\[ ALC = CSR \times LC \times P \]

\[ ALC = 23,725 \times 30 \times 20.9\% \]

\[ ALC = 148,755.75 \times 0.00 \]

\[ ALC = 148,755.75 \times 0.00 \]

\[ ALC = 4710.00 \text{ Ethiopian birr} \]

Indirect financial loss is due to carcass weight reduction as a result of Fasciolosis. From 750 inspected animals 157 were identified as positive in the study abattoir which results in a total of 118,692 EB losses as a result of carcass weight reduction (indirect loss) during the five study months. In the study area the average price of 1 kg beef was 60 EB the annual finical loss from carcass weight reduction due to bovine Fasciolosis calculated as follows.

\[ ACW = CSR \times 10\% \times CL \times BC \times P \]

\[ ACW = 23,725 \times 10\% \times 20.9\% \times 60 \times 126 \text{ kg} \]

\[ ACW = 374,844.9 \text{ EB} \]
Table 1: Overall Prevalence of Fasciolosis at Adama Municipality Abattoir

<table>
<thead>
<tr>
<th>No. of examined animals</th>
<th>Number of positive animals</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>750</td>
<td>157</td>
<td>20.9(%)</td>
</tr>
</tbody>
</table>

Table 2: Proportion of species of *Fasciola* encountered in affected Livers during postmortem Examination.

<table>
<thead>
<tr>
<th>Fasciola Species</th>
<th>Number of examined positive livers</th>
<th>Proportion (%)</th>
<th>Overall Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>F. hepatica</em></td>
<td>102</td>
<td>64.97</td>
<td>13.6</td>
</tr>
<tr>
<td><em>F. gigantica</em></td>
<td>40</td>
<td>25.48</td>
<td>5.3</td>
</tr>
<tr>
<td>Mixed infection</td>
<td>15</td>
<td>9.55</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table 3: Prevalence of Fasciolosis in different body condition groups

<table>
<thead>
<tr>
<th>Body condition</th>
<th>No. of animals examined</th>
<th>No of positive cases</th>
<th>Prevalence with in the body condition (%)</th>
<th>Overall prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>37</td>
<td>22</td>
<td>59.46</td>
<td>2.9%</td>
</tr>
<tr>
<td>Medium</td>
<td>189</td>
<td>96</td>
<td>59.79</td>
<td>12.8%</td>
</tr>
<tr>
<td>Good</td>
<td>524</td>
<td>39</td>
<td>7.44</td>
<td>5.2%</td>
</tr>
</tbody>
</table>

\[ X^2 = 199.65, df=2, p-value=0.00 \]

Therefore, the total annual financial loss due to bovine Fasciolosis in the abattoir was the summation of the loss from organ (liver) condemnation (direct loss) and carcass weight reduction (indirect loss which was 523, 600 EB). This indicates that about 71.59% of the overall estimated loss was found to be attributable to carcass weight reduction while only 28.41 % of the loss accounts from organ condemnation.

**DISCUSSION**

Different bovine disease cause condemnation of liver and other organs in slaughter houses in different places. There is a mounting evidence that Fasciolosis exists in almost all regions of Ethiopia with a ranging from 11.5% to 87% [19] and different studies carried out on the importance of Fasciolosis showed enormous economic impacts of disease in livestock production.

The prevalence of Bovine Fasciolosis (20.9%) in the present study at Adama municipal abattoir revealed lower compared with higher prevalence’s reported by Wondosenin Arsi [20] and Ademin Zeway [7], who reported a prevalence of 53.52% and 56.8 % respectively. The probable reason for this difference may be due to the absence of suitable ecological features for the intermediate host snails over mass of areas on the origins of animals slaughtered at the study abattoir. In addition to this due to the expansion of veterinary services, awareness was created among the people about the advantage of periodically deworming of animals. In other places of Ethiopia, relatively lower prevalence were reported such as the ones reported by Haymanot in Harar [21], who found a prevalence of Fasciolosis to be 12.1%. At the same time of study by Shiferaw et al. [22] in and around Asela found the prevalence of 45.2 %, this is because of the favorable condition of snails in the area.

The species of Fasciola involved in causing Fasciolosis in the study area were examined. Out of 157 Fasciola infected livers encountered during postmortem examination. 102(64.97%) were infected by *F. hepatica* 40 livers (25.48%) were infected by *F. gigantica* and 15 livers (9.55%) were infected by both *F. hepatica* and *F. gigantica*. Thus the predominant species involved in causing bovine Fasciolosis in the present abattoir was *F. hepatica* and this may be associated with the existence of favorable ecological conditions for *L. truncatula* (intermediate host of *F. hepatica*) in the source origins of cattle presented to the study abattoir. Swampy areas around lakes and marsh areas in low lying plain areas and temporary ponds provide favorable habitat for *L. truncatula* [23], this might have contributed to the frequent occurrence of *F. hepatica* in cattle.

This relatively low prevalence of *F. gigantica* encountered in the body abattoir may be associated with presence of intermediate host *L. natalensis* in the habitats of borders of lakes flood prone areas and drainage ditches [24].

Graber, [4] reported coexistence of both species of Fasciola in areas with an altitude range of 1200 - 1800 m.a.s.l which supports the finding of the present study conducted at Adama municipal abattior. Mixed infection by both species of Fasciola may occur in the liver of the same animale is attributing to the existence of ecological condition conducive for replication of both species of snails (intermediate hosts) and intermingling of cattle from different grazing areas. Comparative result was reported by [7] and [2].

Prevalence of bovine fasciolosis was statistically analyzed on the basis of body condition score to determine the impact of the disease in animals with different body condition scores. The result of the present
study indicated that occurrence of Fasciolosis has significant difference (p<0.05) in relation to body condition of the animals.

The direct financial loss incurred during this study as a result of condemnation of liver, was estimated to be about 148, 755.75EB per annum and indirect economic loss due to carcass weight reduction /indirect loss was estimated to be about 374, 844.9 EB per annum. There fore the total annual financial loss due to fasciolosis in the study abattoir was the summation of loss from organ (liver) condemnation and carcass weight reduction, which was equal to 523, 600 EB which is higher compared to other financial losses reported by Wondwossen in Arsi [20] (159, 704EB) and by Adem in Ziway (154, 188EB) [7] and Daniel in Dire Dawa (215, 000 EB) [25]. The huge amount of financial loss needs serious attention in the prevention and control of Fasciolosis in the the study area.

CONCLUSION

The result of the present study revealed an overall prevalence of bovine Fasciolosis to be 20.9% in Adama. *F. asciola hepatica* was found to be the most prevalent liver fluke species affecting cattle slaughtered in the study abattoir, which was 64.97% of total liver fluke infection. Where *F. gigantica* and mixed infection forms of fasciolosis recovered were 25.58% and 9.55% of the total liver fluke infections respectively. Fasciola infection has a statistically significant association with the animals body condition.

The current study also indicated that significant prevalence of bovine fasciolosis resulting in significant financial loss due to liver condemnation and carcass weight reduction in the study abattoir were noted. The financial loss incurred due to liver condemnation averages 1950 and 148, 755, 75 Ethiopian birr per day and annum respectively. The result of this study indicated that fasciolosis is an economically important disease causing a direct and indirect financial loss in the study area.

There fore based on the above conclusion the following recommendations are forwarded:

- Futher study should be conducted on the epidemiology of the disease biology and ecology of intermediate host snail in order to foster planning and implementenation of suitable prevention and control strategies.
- Moderanization of traditional managemental paractice through raising the awarness for livestock owners.
- The low lying well marsh pastures should not be grazed by animals particulary during dry season of the year to reduce infection.
- Strategic anthemetic treatment with appropirate flukicidal drugs should be practiced two times ayear i.e after the end of dry season and after the end of rain season.

REFERENCES


