Study on the Prevalence and Economic Importance of Bovine Fasciolosis in Mizan Teferi Municipal Abattoir, Southern Ethiopia

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Abstract: A cross-sectional study was conducted in Bench maji zone, Mizan teferi municipal abattoir, Southern Ethiopia to determine the abattoir based prevalence and intensity of pathological lesions in cattle using post-mortem examination of each slaughtered animal. Direct and indirect economic loss was assessed by using post-mortem examination of each liver and retrospective secondary data respectively. A total of 384 slaughtered animals were taken for post-mortem examination to search Fasciola parasite in the liver from December 2011- May 2012. Out of 384 cattle examined 56(14.6%) were positive for Fasciola. Depending on the intensity of pathological lesions, the liver was classified as severe 28(50%), moderate 16(28.6%) and slight 12(21.4%). The more prevalent species of Fasciola was Fasciola gigantica 34(8.9%), while Fasciola hepatica 11(2.9%), mixed form 5(1.3%) and immature or unidentified form of Fasciola was 6(1.6%). There is statistically association P < 0.05 between body condition and the fasciolosis where poor body condition cattle are more infected with the disease. The economic loss due to liver condemnation was 1972.7 US$ and carcass condemnation was calculated as 30, 973.33 US$ annually and the summation of direct and indirect economic loss is 32, 946.03 US$. In conclusion, attention is needed to minimize direct and indirect economic loss due to fasciolosis in cattle.

Key words: Abattoir • Bovine Fasciolosis • Economic importance • Mizan Teferi • Prevalence

INTRODUCTION

Fasciolosis is an important disease entity causing considerable loss of revenue due to condemnation of affected liver and carcass weight reduction. Bovine fasciolosis is an economically important parasitic disease of cattle in tropical and subtropical countries that limit productivity of animals. Fasciolosis is caused by fasciolidae, which are trematodes of the genus Fasciola, species Fasciola hepatica or Fasciola gigantica [1], [2]. Intermediate host of F. hepatica and F. gigantica are fresh water snails from family Lymnaeidae [3]. Lymnaea truncatula is the most common intermediate host for F. hepatica in different part of the world [4]. The most important intermediate hosts of F. gigantica are Lymnaea natalensis and Lymnaea auricularia [1, 5]. Fasciola hepatica measures 2 to 3 cm and F. gigantica measures 4 to 10 cm in length [6].

Generally the distribution of fasciolosis is worldwide [5]. Fasciola hepatica predominates in temperate zone while F. gigantica is found primarily in tropical regions [7]. The major hosts of fasciolosis are most mammals, sheep and cattle [1]. In Ethiopia the prevalence of bovine fasciolosis has shown to range from 11.5% to 87%. Fasciola hepatica was shown to be the most important fluke species in Ethiopia live stock with distribution over three quarter of the nation except in the arid North-East part of the area while the national distribution of F. gigantica was mainly localized in the Western humid zone of the country comprising approximately one fourth of the nation [8].

Fasciolosis cause economic losses due to condemnation of livers at slaughter and production losses especially due to reduced weight gain [9]. These losses are associated with mortality, morbidity, reduced growth rate, condemnation of fluke infected liver, also increased susceptibility to secondary infections and expense due to control measures [8]. Recently, worldwide loss in animal productivity due to fasciolosis was conservatively estimated at over US$3.2 billion per annum [10]. The annual loss due to endoparasites in Ethiopia is estimated at 700 million Ethiopian birr/annum [11].
Therefore, the main objective of this study was:

- To determine prevalence of bovine fasciolain Mizan teferi municipal abattoir.
- To identify most common species of Fasciola in the abattoir.
- To assess economic importance of bovine fasciolosis in the study area.

**MATERIALS AND METHODS**

**Study Area:** The study was conducted in Bench maji zone, Mizan teferi municipal abattoir which is located in Southern Ethiopia. Geographically Bench maji zone is located between 5°33’ to 7°21’N latitude and 34°88’ to 36°14’E longitude and has an altitude ranging from 500-2500m above sea level. Agro-ecologically the zone is divided in to lowland (50%), midland (45%) and highland (5%). The average annual rainfall ranges 400-2, 000 mm and annual mean temperature ranges between 15.1-27°C [12].

**Study Animals:** The study was conducted on a total of 384 indigenous cattle. Simple random sampling was used for both infected and non infected animals irrespective of their body condition and agro-ecology of the area where they come. 95% confidence interval and 50% of expected prevalence were used to determine the sample size [13].

\[
 n = \frac{1.962P_{exp}(1-P_{exp})}{d^2}
\]

where \( n \) = the sample size, \( P_{exp} \) = the expected prevalence = 50%, \( d \) = the desired absolute precision = 5%. Hence, \( d = 0.05 \) and \( p = 0.5 \) (50%) [13].

**Study Design:** A cross-sectional study was conducted from December 2011-May 2012 to determine the abattoir based prevalence and intensity of pathological lesions in cattle using post-mortem examination of each slaughtered animal. Direct economic loss was assessed by using post-mortem examination of each liver and using retrospective secondary data. Liver of each slaughtered animals were examined by visualization and palpation followed by transverse incision of the organ across thin left lobe in order to confirm presence of Fasciola parasite. Fasciola species found on the liver were collected in to universal bottle to further examine in the laboratory based on the morphological features and classified in to *F. hepatica, F. gigantica* and unidentified to Fasciola or immature forms of liver fluke [14]. All Fasciola positive liver was totally condemned as unfit for human consumption. The affected liver (Fasciola positive liver) was classified as lightly affected, moderately affected and severely affected according to the intensity of pathological lesions of the organ. The interpretation is as follows, lightly affected; half of the organ is affected and only one bile duct is prominently enlarged on the visceral surface of the liver. Moderately affected; half of the organ is affected and two or more bile ducts are hyperplastic. Severely affected; almost the entire organ is involved the liver is cirrhotic and triangular in outline as the right lobe is often atrophied. Body condition scoring (BCS) of the animals was classified in to poor (BCS 1-3), medium (BCS 4-6) and good (BCS 7-9) based on body condition criteria to evaluate statistical association.

**Data Collection:** Appropriate data was collected by using post-mortem examination of the organs. An interview were made with butcher men producing at Mizan teferi municipal abattoir to obtain information on the average price of liver and amount of liver condemned per animal.

**Data Management and Data Analysis:** A raw data were recorded, coded and entered to Microsoft Excel database system to be analyzed using SPSS version15.0. Prevalence of fasciolosis was calculated as the number of cattle found to be infected with Fasciola expressed as a percentage of the total number of the cattle slaughtered [14]. P-value less than 0.05 (at 5% level of significance) were considered significant in all analysis. Annual slaughtered rate was estimated from retrospective abattoir records from March 2011- March 2012, while retail market price of an average size zebu liver was determined by interview from the butcheries of Mizan teferi town. The annual liver condemnation (direct loss) was calculated by formula set by Ogunrinade and Ogunrinade [15].

\[
 ALC = MCS \times MLC \times P
\]

where ALC=Annual loss from liver condemnation, MCS= Mean annual cattle slaughtered at Mizan teferi abattoir, MLC= Mean cost of one liver in Mizan teferi town, \( P = \) Prevalence rate of the disease at the study abattoir.

A 10% carcass weight loss due to fasciolosis in cattle [16]. Average carcass weight of an Ethiopian zebu was taken as 126 kg [17]. The annual indirect economic loss was assessed using the formula set by Ogunrinade and Ogunrinade [15].
ACW = CSR x CL x BC x P x 126 kg

where ACW = Annual loss from carcass weight reduction, CSR = Average number of cattle slaughtered per annum at study abattoir, CL = Percentage of carcass reduction, BC = an average price of 1 kg beef meat in the town, P = Prevalence rate of fasciolosis at Mizan teferi abattoir, 126 kg = Average carcass weight of Ethiopian zebu.

RESULTS

Prevalence of the Fasciola: Among 384 post-mortem examined animals 56 (14.6%) were positive for fasciolosis. (Table 1).

Animals slaughtered in the abattoir were come from Wacha maji, Temenjaj and Mizan areas. The highest portion of animals were from Wacha maji 255(66.4%), Mizan town 70(18.2%) and Temenjaj 59(15.4%). Specifically the prevalence of *F. hepatica* was higher than *F. gigantica* in Mizan town while, in Temenjaj and Wacha maji higher prevalence of *F. gigantica* was found (Table 2).

Fasciola species identification was done based on their morphological characteristics. The overall species identification reveals that 11(2.9%) were *F. hepatica*, 34(8.9%) *F. gigantica*, 5(1.3%) mixed form and 6(1.6%) of them also immature or unidentified form of Fasciola. The greater percent from the species is *F. gigantica* 34(8.9%) (Table 3).

A total of 56 Fasciola positive livers were examined to determine the intensity of pathological lesions. According to their intensity of pathology they are classified in to severe 28 (50%), moderate 16 (28.6%) and slight 12 (21.4%) (Table 4).

Out of 63 poor body condition scored cattle slaughtered 23 (36.5%) of them were positive for fasciolosis. From 222 medium body condition scored cattle 27 (12.2%) were positive for fasciola. Out of 99 good body condition scored cattle 6(6.1%) were also positive. This result showed that it is 9 times more likely positive cattle to become poor in their body condition score (Table 6).

Direct and Indirect Economic Loss Assessment: The average annual cattle slaughtered was estimated to be 3, 641 cattle, while the mean retail price of bovine liver in Mizan teferi town was 64.2 Ethiopian birr during the study period. The prevalence of fasciolosis in Mizan teferi municipal abattoir was found to be 14.6%. Therefore, the estimated annual direct economic loss from organ condemnation is 34, 127.8 Ethiopian birr (1972.7 US$) and the indirect economic loss due to carcass weight reduction as a result of fasciolosis infestation was 535, 838.688 Ethiopian birr (30, 973.33 US$) (1 kg beef meat was 80 Ethiopian birr during the study period). Therefore, the total annual economic loss due to bovine fasciolosis in the study abattoir is the summation of the losses from organ condemnation (direct loss) and carcass weight...

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### Table 1: Prevalence of bovine fasciolosis in Mizan teferi municipal abattoir

<table>
<thead>
<tr>
<th>Result for fasciolosis</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasciola positive</td>
<td>56</td>
<td>14.6%</td>
</tr>
<tr>
<td>Fasciola negative</td>
<td>328</td>
<td>85.4%</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

### Table 2: Source of animals and species of Fasciola

<table>
<thead>
<tr>
<th>Source of animals</th>
<th>F. hepatica</th>
<th>F. gigantica</th>
<th>Mixed</th>
<th>Immature</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wacha maji</td>
<td>7</td>
<td>25</td>
<td>2</td>
<td>6</td>
<td>40(15.7%)</td>
<td>215(84.3%)</td>
<td>255(66.4%)</td>
</tr>
<tr>
<td>Mizan town</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>8(11.4%)</td>
<td>62(88.5%)</td>
<td>70(18.2%)</td>
</tr>
<tr>
<td>Temenjaj</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>8(13.5%)</td>
<td>51(86.4%)</td>
<td>59(15.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>34</td>
<td>5</td>
<td>6</td>
<td>56(14.6%)</td>
<td>328(85.4%)</td>
<td>384(100%)</td>
</tr>
</tbody>
</table>

Chi square($X^2$) = 13.734, P-value=0.89

### Table 3: Fasciola species identification

<table>
<thead>
<tr>
<th>Fasciola species</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasciola hepatica</td>
<td>11</td>
<td>2.9%</td>
</tr>
<tr>
<td>Fasciola gigantica</td>
<td>34</td>
<td>8.9%</td>
</tr>
<tr>
<td>Mixed form</td>
<td>5</td>
<td>1.3%</td>
</tr>
<tr>
<td>Immature or unidentified form</td>
<td>6</td>
<td>1.6%</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Table 4: Intensity of pathological lesions in the liver

<table>
<thead>
<tr>
<th>Intensity of pathology in the liver</th>
<th>No. of liver (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe</td>
<td>28 (50%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>16 (28.6%)</td>
</tr>
<tr>
<td>Slight</td>
<td>12 (21.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>56 (100%)</td>
</tr>
</tbody>
</table>

Table 5: Fasciola species and intensity pathological lesions in the liver

<table>
<thead>
<tr>
<th>Species of lesions in liver</th>
<th>Fasciola Hepatica</th>
<th>Fasciola Gigantica</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severe</td>
<td>Moderate</td>
<td>Slight</td>
</tr>
<tr>
<td>Fasciola Hepatica</td>
<td>4 (33.3%)</td>
<td>3 (25%)</td>
<td>4 (41.7%)</td>
</tr>
<tr>
<td>Fasciola Gigantica</td>
<td>22 (64.7%)</td>
<td>8 (23.5%)</td>
<td>4 (11.8%)</td>
</tr>
<tr>
<td>Mixed form</td>
<td>2 (40%)</td>
<td>2 (40%)</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>Immature or unidentified form</td>
<td>0 (0%)</td>
<td>3 (50%)</td>
<td>3 (50%)</td>
</tr>
</tbody>
</table>

Chi-square ($X^2$) = 11.399, P-value = 0.77

Table 6: Body condition and prevalence of Fasciola

<table>
<thead>
<tr>
<th>Body condition score</th>
<th>Fasciola positive</th>
<th>Fasciola negative</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>23 (36.5%)</td>
<td>40 (63%)</td>
<td>63 (16.4%)</td>
</tr>
<tr>
<td>Medium</td>
<td>27 (12.2%)</td>
<td>195 (87.8%)</td>
<td>222 (57.8%)</td>
</tr>
<tr>
<td>Good</td>
<td>6 (6.1%)</td>
<td>93 (93.9%)</td>
<td>99 (25.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>56 (14.6%)</td>
<td>328 (85.4%)</td>
<td>384 (100%)</td>
</tr>
</tbody>
</table>

Chi-square ($X^2$) = 31.129, P-value (P < 0.001)

Odds Ratio (OR) = poor/good = 8.91

reduction (indirect loss) which is around 569, 966.488 Ethiopian birr (32, 946.03 US$). This economic loss had a great contribution in the economy of the country as whole.

**DISCUSSION**

The study conducted at Mizan teferi municipal abattoir through post-mortem examination of 384 slaughtered cattle revealed a prevalence rate of was 14.6% (56/384). This result was less than with the prevalence of bovine fasciolosis reported in Jimma municipal abattoir 46.5% [18], at Kombolcha industrial abattoir 28% [19], in and around Assela 45.25% [20], 90.65% in North part of Ethiopia [21], the prevalence reported in Adwa municipal abattoir 32.3% [22] and even the recent study reported at Jimma abattoir with prevalence of 53.48% [14]. The prevalence rate found during the research study in Mizan teferi was nearly agree with the prevalence reported in Wolaita Soddo 12.7% [23] and the prevalence rate in Hai town, Tanzania 14.05% [24]. The reason for variation of fasciolosis prevalence rate in abattoir is due to variation in agro-ecological and climatic conditions like temperature, rainfall, altitude, livestock management system and availability of suitable intermediate host (snail) and the parasite (Fasciola).

The agro-ecology of study area Mizan teferi is an altitude ranging 500-2500 above sea level and thus, according to Yilma and Malone [25] *F. gigantica* is found at an altitude below 1800 m above sea level. While *F. hepatica* is found at altitude of 1200-2560 m above sea level. Mixed infections by both species can be encountered at 1200-1800 m above sea level. Agro-ecologically the zone is divided in to lowland (50%),
midland (45%) and highland (5%). Therefore, the major part of the area is covered lowland (50%), thus it is preferable for distribution of *F. gigantica* intermediate host. This may be explained by cattle brought for slaughter from highland and middle altitude zone flood prone areas, drainage ditches are favourable habitat to *Lymnaea natalensis* [1].

Animals were brought to municipal abattoir from Wacha maji, Temenjaj and Mizan areas for slaughter. The highest population were from Wacha maji 255(66.4%) than the rest Mizan town 70 (18.2%) and Temenjaj 59 (15.4%). The source of animals and the species of the parasite they harboured was statistically not correlated (P >0.05).

The Fasciola parasite species found during the study was *F. hepatica, F. gigantica*, mixed form and immature or unidentified form of Fasciola with the prevalence of 19.6%, 60.7%, 8.9% and 10.7% respectively. The most common prevalent species of Fasciola parasite found during the study was *F. gigantica* 60.7%. When we compare the prevalence rate *F. gigantica* in Ethiopian status this prevalence was higher than prevalence rate of *F. gigantica* in Kombolcha industria abattoir 24.3% [19] and 26.54% at Jimma abattoir [14]. In agreement with this study the report at Wolaita Soddo prevalence of *F. gigantica* was higher 64.9% [23]. The variation of prevalence between species of Fasciola parasite was the availability of intermediate host for *F. gigantica*.

The prevalence of Fasciola was high in poor body condition cattle 23(36.5%), than medium body condition 27(12.2%) and good 6(6.1%). There is also statistically significance between body condition of cattle and Fasciola infection (P<0.05). It is grossly known poor body condition cattle were less resistant to Fasciola infection (Table 6). According to the classification of Ogunrinade and Adegoke [26] the total examined liver were classified in to severe, moderate and slight with the percent of 28(50%), 16(28.6%) and 12(21.4%) respectively depending on the intensity of pathological lesions.

The infection of Fasciola parasite in the Mizan teferi abattoir caused condemnation of liver of slaughtered cattle resulting direct economic loss and carcass weight loss in indirect economic loss. All Fasciola positive livers were condemned as unfit for human consumption because, it is not usual to process such organ in local set up to be approved fit for human consumption. With total number of annually slaughtered cattle 3, 641 having loss of 34, 127.8 Ethiopian birr (1, 972.7 US$) from direct liver condemnation and 535, 838.688 Ethiopian birr (30, 973.33 US$) from carcass weight reduction resulting a summation of 569, 966.488 Ethiopian birr (32, 946.03 US$). This value is less than with annual Adwa municipal abattoir condemned liver price 4, 674.2 US$ [1]. The main factor for price difference was the prevalence rate of Fasciola was greater in Adwa 32.3% [1] than Mizan teferi, even the exchange of US$ with Ethiopian birr and the price of each liver vary with time.

**CONCLUSION**

Bovine fasciolosis study was carried out in to know the prevalence and economic importance at Bench maji zone, Mizan teferi municipal abattoir. Fasciolosis is an important condition that leads to high liver condemnation (direct loss) and weight reduction (indirect loss) having contribution in economic reduction of the country. The dominant Fasciola species revealed was *F. gigantica* than *F. hepatica*, mixed and immature form. In general it can be concluded that 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.

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**REFERENCES**


