Prevalence and Economic Losses of Bovine Fasciolosis at Hawzien Abattoir, Tigray Region, Northern Ethiopia

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Abstract

A cross sectional study was conducted from July 2013 to March 2014 to evaluate the prevalence and economic impact of bovine fascioliosis at Hawzien abattoir, Eastern Tigray, Northern Ethiopia. A total of 215 cattle were randomly selected from those cattle slaughtered at Hawzien abattoir. Liver and related bile ducts were carefully inspected by visual inspection, palpation and systematic incision. Data were analyzed using SPSS statistical software version 16.0. P-values <0.05 were considered statistically significant. The overall prevalence of bovine fasciolosis in the present study was 46 (21.39%) among the total slaughtered cattle in the abattoir. The current finding showed that Fasciola hepatica was higher prevalent than Fasciola gigantica with 17.21% and 4.2% respectively. Comparisons were made among the examined animals based on their sex, age and body condition. Accordingly, sex and age didn’t show effects in cattle examined (p>0.05). However, body condition had effect on the prevalence of fasciolosis (p<0.05) with higher infection occurring in medium body conditions. The total annual direct economic loss as a result of liver condemnations was 885,500 ETB indicating that the disease is economically important on livestock production system in the study area.

Keywords: Abattoir, bovine fasciolosis, economic loss, hawzien, prevalence.
**Introduction**

Bovine fasciolosis is an economically important parasitic disease of cattle caused by fasciolidae trematodes of the genus Fasciola (Keyyu et al., 2005). The two most important species of this genus, *F. hepatica* and *F. gigantica*, are commonly known as liver flukes. Cattle and other ruminants are the most important species of farm livestock affected by Fasciola species. Generally, the distribution of fasciolosis is worldwide; *F. gigantica* is geographically restricted to South America and Africa, however, the distribution of *F. hepatica*, is limited to temperate areas and highlands of tropical and sub-tropical regions (Urquhart et al., 1996). The definitive hosts for *F.hepatica* are most mammals among which sheep and cattle are the most important once. The geographic distribution of trematode species is dependent on the distribution of suitable species of snails. The genus Lymnaea in general and *L. truncatula* in particular is the most common intermediate hosts for *F. hepatica*. This species of snail is reported to have a worldwide distribution (Urquhart et al., 1996).

The presence of fasciolosis due to *F. hepatica* and *F. gigantica* in Ethiopia has long been known and its prevalence and economic significance has been reported by several researchers; different works so far conducted in Ethiopia reported variable prevalence rates of bovine fasciolosis in different localities of the country (Tilahun et al., 2006; Tolosa and Tigre, 2007; Fufa et al., 2009; Gebretsadik et al., 2009; Rahmeto et al., 2010). In Ethiopia, the prevalence of bovine fasciolosis has shown to range from 11.5% to 87% (Malone et al., 1998; Tilahun et al., 2006; Fufa et al., 2009; Berihun, 2012; Mihretab et al., 2010).

*F. hepatica* was shown to be the most important fluke species in Ethiopian livestock with distribution over three quarter of the nation except in the arid north-east and east of the county. The distribution of *F. gigantica* is mainly localized in the western humid zone of the country that encompasses approximately one fourth of the nation (Malone et al., 1998). Moreover, different studies also showed that fasciolosis has higher economic significance on animal production and productivity. The economic losses due to fasciolosis throughout the world are enormous and these losses are associated with mortality, morbidity, reduced growth rate, condemnation of liver, increased susceptibility to secondary infections and expense due to control measures (Malone et al., 1998). A rough estimate of the economic loss due to decreased productivity caused by bovine fasciolosis is recorded from different abattoirs of the country. According to the study conducted by Mihreteab et al., (2010) and Amene et al., (2012) a total economic loss of about 57,960 and 125,842 Ethiopian birr per annum in cattle were reported due to fasciolosis at Adwa and Jimma municipal abattoirs, respectively. Particularly in eastern zone of Tigray some studies have been conducted on prevalence bovine fasciolosis such as a studies conducted by Berihun (2012) and Alembhran and Haylegebriel (2013) at Adigrat municipal abattoir reported 21.5% and 9.26%, respectively. Economic loss due to bovine fasciolosis from two year retrospective data of Adigrat municipal abattoir was about 18,620.00 Ethiopian birr (Alembhran and Haylegebriel, 2013). However, no studies are conducted on prevalence and economic losses of bovine fasciolosis at Hawzien abattoir as effective bovine fasciolosis control programs require deep knowledge on the infection prevalence and its economic significance. Therefore, this study was aimed to assess the prevalence and economic losses of bovine fasciolosis due to liver condemnation at Hawzien abattoir, Tigray region, Ethiopia.

**Materials and Methods**

**Study Area**

The current study was conducted at Hawzien abattoir, from July 2013 to March 2014. Hawzien town is found in eastern zone of Tigray about 888 km from Addis Ababa, capital city of Ethiopia and 102 km from Mekelle the capital city of Tigray regional state. Hawzien is located at 014°16’34” N latitude and 039° 27’51”E longitudes and its altitude ranges from 1500-2800 meter above sea level. The mean annual rain fall is 325mm to 690mm. The rainy season of the area is from June to September and the annual minimum and
maximum temperature is 10ºc and 25ºc, respectively. Prevailing agricultural system is the main occupation of the area with integrated annual crop and livestock production in which oxen provides the power for ploughing smallholder’s fields.

Study Animals and Study Design

The study animals were cattle brought to the abattoir for slaughter from different localities around Hawzien town. A cross sectional active abattoir survey was conducted from July 2013 to March 2014 to assess the prevalence of Bovine fasciolosis and its economic losses at Hawzien abattoir, Northern Ethiopia.

Sample Size and Sampling Technique

The required minimum sample size was estimated using formula described by Daniel (1995) as follows: 

\[ n = \frac{z^2p_{\text{exp}}(1-p_{\text{exp}})}{d^2} \]

Where, \( n \) = required sample size; \( z \) = standard value; \( p_{\text{exp}} \) = expected prevalence of bovine fasciolosis in the study area; \( d \) = desired absolute precision. At 95% confidence interval \( Z=1.96 \) and \( d = 5\% \). The reported prevalence from active abattoir survey in study area was 15.3% (Alembhran and Haylegebriel, 2013).

\[ n = \frac{(1.96)^2 (0.153)(0.84)}{(0.05)^2} = 199 \]

But to increase the precision of the result a total of 215 cattle were examined. During ante-mortem examination, each of study animals were marked by color marker and their age, sex and body condition scoring was recorded. The age of the animals was determined according to their dentitions as described by Kelly (1975) and two age groups were considered as below and above five years. Body
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condition scoring was done according to Nicholson and Butter Worth (1986) and classified in to two categories; medium and good. During postmortem examination, liver and related bile ducts were carefully inspected by visual inspection, palpation and systematic incision for the presence of fasciola species (Getaw et al., 2010). The Fasciola species were identified by their morphological features according to Urguhart et al., (1996).

Assessment of direct economic losses due to liver condemnation was estimated based on annual slaughtered capacity of the abattoir, average market price of liver in the study area and rejection rate of liver or prevalence of the disease. The Annual slaughtered rate of the abattoir was estimated from retrospective abattoir record of the last years and average market price of liver was determined by interviewing personnel of the abattoir and butchers. The annual economic loss due to liver condemnation was estimated by the formula set by Ogunrinade and Ogunrinade (1980) as follows:

\[ EL = Ecs \times Coy \times Roz \]

Where, EL = Annual economic loss estimated due to liver condemnation; Ecs= Annual number of cattle slaughtered in the abattoir; Coy = Average cost of liver in the study area; Roz = Condemnation rate of liver or prevalence of bovine fasciolosis in the area.

Statistical Analysis

Collected data were entered in to Microsoft excel and analyzed by SPSS version 16. Prevalence of bovine fasciolosis was calculated as the number of positive cattle divided by the total number of cattle examined. Chi square test was used to evaluate the association between bovine fasciolosis and host related factors like sex, age and body conditions. P - Value less than 0.05 was considered as statistical significant.

Results

The overall prevalence of bovine fasciolosis in the present study was 46 (21.39%) among the total slaughtered cattle in the abattoir. Of the total 215 examined animals 49 were below five years and 166 of them were above five years. Fasciolosis were detected in all groups of age and higher prevalence of fasciolosis were recorded in the below five years 34.68%. Age did not show an effect (p > 0.05) (Table 1).

<table>
<thead>
<tr>
<th>Age</th>
<th>Total cattle examined</th>
<th>F. hepatica</th>
<th>F. gigantica</th>
<th>X²</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;5 years</td>
<td>166</td>
<td>22 (13.25%)</td>
<td>7 (4.21%)</td>
<td>1.43</td>
<td>0.231</td>
</tr>
<tr>
<td>&lt;5 years</td>
<td>49</td>
<td>15 (30.6%)</td>
<td>2 (4.08%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>215</td>
<td>37 (17.21%)</td>
<td>9 (4.2%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the body conditions (good and medium), the highest prevalence of fasciolosis was recorded in medium body conditions 37.78%. Body condition had an effect (p<0.05) in the prevalence of bovine fasciolosis (Table 2).

<table>
<thead>
<tr>
<th>Body condition</th>
<th>Total cattle examined</th>
<th>F. hepatica</th>
<th>F. gigantica</th>
<th>X²</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>170</td>
<td>23 (13.53%)</td>
<td>6 (3.53%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>45</td>
<td>14 (31.11%)</td>
<td>3 (6.67%)</td>
<td>3.96</td>
<td>0.047</td>
</tr>
<tr>
<td>Total</td>
<td>215</td>
<td>37 (17.21%)</td>
<td>9 (4.2%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the sex, the highest prevalence of fasciolisis was recorded in male (21.12%). Sex did not show an effect (p > 0.05) (Table 3).
Table 3: Prevalence of bovine fasciolosis by sex.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Total cattle examined</th>
<th>Prevalence (%)</th>
<th>X²</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F.hepatica</td>
<td>F.gigantica</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>195</td>
<td>33 (16.92%)</td>
<td>9 (4.2%)</td>
<td>2.86</td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>4 (20.00)</td>
<td>0 (0.00)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>215</td>
<td>37 (17.21)</td>
<td>9 (4.2%)</td>
<td></td>
</tr>
</tbody>
</table>

Assessment of Annual Economic Losses

The direct economic losses due to liver condemnation was estimated based on annual slaughter capacity of the abattoir, average market price of liver in the study area and rejection rate of liver or prevalence of the disease. The Annual slaughtered rate of the abattoir was estimated from retrospective abattoir record of the last years and average market price of liver was determined by interviewing personnel of the abattoir and butchers. Therefore, according to the renainal mean average price of single bovine liver and 1kg meat price in the study area was 50 and 80 Birr respectively. The average number of cattle slaughtered and percentage of the liver condemnation pernum was 385 and 46. Based on the information, total economic loss due to bovine fasciolosis as a result of liver condemnation meat production was 885,500 ETB.

Discussion

Fascioliasis is major diseases which impose direct and indirect economic loss on lives stock production particularly of sheep and cattle. The current study conducted at Hawzien abattoir revealed that overall prevalence of bovine fasciolosis was 21.39%. The prevalence of bovine fasciolosis in the present study showed close similar with study conducted in Nekemte Municipal abattoir, Oromia regional state, Ethiopia with the prevalence rate of 21.9% (Alula Petros et al., 2013). The present result also showed almost similar with the finding of Mebrahtu and Beka (2013) which is conducted in Eastern Ethiopia, Dire Dawa administration with the prevalence rate of 24.44%. However, the present finding is higher when it compared with the work of Fufia et al., (2009) which is conducted at Welayta soddo municipal abattoir with prevalence rate of 12.7%, Swai and Ulicity (2009), which is conducted at Havi, Tanzania municipal abattoir with the prevalence rate of 14.05% and Melaku et al., (2012) at Dessie municipal abattoirs with prevalence rate of 13.61%. The higher prevalence rate of fasciolosis in the present study might be due to the variation in agro-ecological conditions favorable for both the parasites and the intermediate of the host.

On contrary, the prevalence of bovine fasciolosis in the present study was lower as compared to with previous prevalence rates that were reported in different parts of Ethiopia (Tadele and Worku, 2007, Mihreteab Bekelle et al., 2010, Mulualem, 1998) at Jimma municipal, at Adwa municipal and at south Gonder municipal abattoir with the prevalence rate of 46.58%, 32.3% and 83.08% respectively. Similarly, the prevalence of bovine fasciolosis in the present study was lower as compared to Dagene (1994) which carried out at Debrebrhan municipal abattoir with the rate of 80%. This variation might be occurred due to the climate-ecological conditions like increasing of altitude, rain fall, temperature, livestock management system, and suitability of the environments for high survival of the parasites. There are several factors that can influence the occurrence of fasciolasis in certain areas. One of the most important factors that influence the occurrence of fasciolasis in certain area is availability of suitable snail habitat (Urguhart et al., 1996). Furthermore, optimal base temperature to the level of 10°C and 16°C is necessary for snail vectors of F.hepatica and F.gigantica, respectively.

The prevalence of bovine fasciolosis based on sex was 21.12 and 20.00 for male and female respectively. The present finding was not consistent with the study conducted by Daniel (1995) at Dire Dawa Abattoir. This variation might be attributed to the proportion of the animals that were sampled during the post-mortem examination were most of
the time male animals are examined under antemortem examinations. From the current study, the prevalence of the parasite on both age were 43.9% and 8.3% for *F. hepatica* and *F. gigantica* respectively. Based on age, higher prevalence of fasciolosis were recorded in the below five years. This might be due to high suitability for those parasites and presence of weak immune defense for those parasites. However, there was no statistically significance (p> 0.05) in the prevalence bovine fasciolosis among two age groups. Based on the body conditions, the highest prevalence of fasciolosis was recorded in medium body conditions. There was statistically significant difference (p<0.05) in the prevalence of bovine fasciolosis among different body condition (Table 2). During this study, the pathological lesion caused by the fascioliasis also showed a considerable economic loss due to organ condemnation. According to the number of liver condemned during the present study period and from the retrospective study data, the direct economic loss due to the fasciolosis was an average estimate of 885,500 ETB. This annual economic loss due to bovine fasciolosis is lower as compared with 2,029,872.10 ETB reported from Dire Dawa Municipal Abattoir (Mebrahun and Beka, 2013). This variation might be due to the difference in number of animals slaughtered at the abattoirs. In cattle producers found in different parts of the world bovine fascioliasis cause vast economic losses in cattle industry, mainly through mortality, liver condemnation, reduced production of meat. In different parts of Ethiopia also bovine fasciolosis caused high economic losses with the annual economic loss of 63,072 ETB and 3,003,488 ETB in Nekemte Municipal abattoir and Jimma Municipal Abattoir respectively (Alula Petros et al., 2013; Dechasa Terefe et al., 2012).

In conclusion, Fasciolosis is a serious health problem of cattle which can causes a liver condemnation and reduction of milk productivity of animals. The high prevalence of the parasites recorded in the current study showed that the disease is common in most parts of zones as the animals were originated from different sites. *F. hepatica* was the most highly prevalent Fasciola in the study area. The highest prevalence recorded in the study area and the loss incurred suggests that a detailed epidemiological study as well as identifying of the overall economic loss due to fascioliasis is required to design the systematic disease prevention and control methods.

**Acknowledgment**

We are grateful for the staff of Hawzien abattoir for their cooperation from the beginning to the end of the study.

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