Financial Losses Arising From Condemnation of Liver Due To Fasciolosis in Cattle from the Western Province of Zambia

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Abstract
An evaluation of financial losses due to bovine fasciolosis in Senanga and Shang’ombo districts in the Western Province of Zambia was carried out retrospectively using abattoir records obtained from Senanga District Veterinary Office. The study covered a period of 10 years from January 2001 to December 2010. Budgetary analysis was used to estimate annual financial losses arising from whole liver condemnations. Findings of the study indicate that 118,477 cattle were slaughtered and the same number of livers examined from 2001-2010, out of which 24,060 (20.77%) whole livers were condemned due to fasciolosis, resulting in a direct financial loss of approximately ZMK 1.2 billion which is currently equivalent to approximately US$ 245,000. This implies an annual loss of approximately US$ 24,500 for the 2 districts only. Considering that large portions of Western, Northwestern, Southern, Central and Northern provinces are flood plains and therefore equally prone to fasciolosis. These findings indicate that this disease condition may be causing significant socio-economic losses to the majority rural poor farmers who depend on livestock as their main source of income and livelihood. Thus there may be need for more efforts in order to reduce the socio-economic losses that may be accruing from fasciolosis and other parasites. The results of this study are significant in the sense that currently there is little or no information on financial losses due to fasciolosis as a result of liver condemnations and thus suggest the dire need for more studies in the rest of Western Province as well as in other flood-prone areas of Zambia.

Keywords: Budgetary analysis, financial losses, liver condemnation, fasciolosis, flood plains, Zambia.

Introduction
Fasciolosis is among important parasitic disease conditions in tropical and subtropical countries which limit the productivity of ruminants, particularly cattle with F. hepatica and F. gigantica being the most commonly reported causative agents in ruminants. Fasciolosis causes direct and indirect economic impacts on livestock production (Dijkhuizen and Morris, 1996). Direct losses are due to condemnation of bovine livers and indirect losses result from death, loss of carcass weight, reduction in milk yield, decline in production (reproductive) performance, predisposition to other infections and cost of treatment among others (Swai and Ulicky, 2009).

Senanga and Shang’ombo districts have a combined total cattle population estimate of 163,000 and livestock rearing is one of the main economic activities in the two districts. On average a total number of 1,200 cattle from both districts are slaughtered monthly in the abattoirs in Senanga and meat is taken to Lusaka and the Copper-belt provinces. Cattle from Shang’ombo are slaughtered at abattoirs in Senanga due to lack of abattoirs in that district. These animals are kept under traditional systems and owned by the rural farmers with one animal currently selling on average at not less than ZMK 1,000,000 (US$ 210). Thus an estimated ZMK 1.2 billion is contributed to the economies of these districts monthly. There are however enormous losses due to partial and whole liver condemnations in abattoirs as a result of bovine fasciolosis.

Estimation of economic losses due to fasciolosis at national or even regional level is currently limited by lack of accurate estimates of the prevalence of the disease (Phiri et al, 2005). Apart from a few reports on this condition in Zambia (Silangwa, 1973; Pandey, 1987; Pandey and Ahmadu, 1998), very little efforts have been made to estimate either the total losses resulting from fasciolisosis infection or even partial losses from the condemnation of livers. Thus in this study an attempt was made to estimate at least the
partial financial losses due to fasciolosis as a result of whole liver condemnations in Senanga and Shang’ombo districts of Zambia.

**Materials and Methods**

**Description of the Study Area**

The study was carried out in Senanga and Shang’ombo districts in the Western Province of Zambia. The province covers an area of about 126,386 km² between latitude 13º 40’ to 17º 35’S and longitudes 22º 00’ to 25º 35’ E. The average rainfall ranges between 760 mm and 1140 mm annually. The human population stands at 881,525 with agriculture and fishing as the main source of livelihood (CSO, 2011). The cattle population in these areas is predominantly traditionally owned and constitutes about 20% of the national herd (Phiri et al 2005). Cattle graze in the Zambezi flood plains from July to January and only move to the uplands when the plains start to get flooded after January (Mumba et al, 2011).

**Study Design**

A cross-sectional retrospective study design was adopted which focused on retrieval and analysis of monthly data from meat inspections carried out at Senanga abattoirs between January 2001 to December 2010.

**Data Analysis**

Data from these meat inspection records were entered and analysed using Microsoft excel spreadsheets. The average number of cattle slaughtered each year and the average number of whole liver condemnations due to fasciolosis were calculated to come up with the disease prevalence estimate. Additionally, 100 livers were weighed to come up with the average weight of a liver and the average sale price of liver per kilogram was obtained through a survey conducted at different meat shops in the study area. Finally, the months of low and high liver condemnation levels during a year were noted and recorded to determine the months with high prevalence and vice-versa.

**Financial Loss Analysis Due To Whole Liver Condemnations**

Budgetary analysis was used to estimate total annual financial losses incurred due to whole liver condemnations for each year from 2001 to 2010 using a number of parameters which included;

- Average number of cattle slaughtered per year
- Prevalence of fasciolosis per year
- Average sale price ($A_v P_{r}$) of liver for each year obtained through a survey conducted at different meat shops.
- Average weight ($A_v W_t$) of liver in mature cattle. The average of 100 livers was 3.63 kg, with the standard deviation being 0.85, the weight ranged from 2.0 kg to 5.6 kg as shown in Table 1 below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.63</td>
</tr>
<tr>
<td>Median</td>
<td>3.58</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.85</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.0</td>
</tr>
<tr>
<td>Maximum</td>
<td>5.6</td>
</tr>
</tbody>
</table>

The direct loss (DL) resulting from condemnations of bovine livers was calculated using the formula in equation 1, as described by Swai and Ulicky, (2009).

\[ DL = TNA \times P_f \times (A_v W_t) \times (A_v P_{r}) \ldots \ldots \text{equation 1} \]
Where:

\[
\text{TNA} = \text{Total number of cattle slaughtered} \\
\text{P}_f = \text{prevalence of fasciolosis} \\
\text{A}_v\text{W}_t = \text{average weight of liver (kg)} \\
\text{A}_v\text{P}_r = \text{average price of liver/kg}
\]

**Results**

Retrospective results indicated that 118,477 cattle were slaughtered and the same number of livers examined during the period 2001-2010, out of which 24,060 whole livers were condemned due to fasciolosis, signifying a prevalence of 20.77%.

Table 2 indicates that the average weight of a mature bovine liver without pathological lesions was 3.63kg. The average sale price of liver was estimated at US$ 2.81 per kilogram, while the average total weight of condemned livers due to fasciolosis was 87,337.80 kg. The average financial loss over the period of 10 years was ZMK 1,165,741,286.00 which is equivalent to US$ 245,419.22 (US$ 1.00= ZMK 4750.00). Assuming constant rate of condemnation, the annual financial loss amounted to ZMK 116,574,128.60 which is equivalent to US$ 24,541.92. This implies an annual loss of approximately US$ 24,500 for the two districts.

**Table 2: Average number of cattle slaughtered, average number of condemned livers, weight of condemned livers, average prevalence and financial losses incurred.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Average No. cattle slaughtered</th>
<th>Average No. livers condemned</th>
<th>Average prevalence</th>
<th>Average weight (kg) of condemned livers</th>
<th>Value (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>9,422</td>
<td>2,131</td>
<td>22.6</td>
<td>7735.53</td>
<td>21,736.84</td>
</tr>
<tr>
<td>2002</td>
<td>15,783</td>
<td>2,578</td>
<td>16.3</td>
<td>9358.14</td>
<td>26,296.37</td>
</tr>
<tr>
<td>2003</td>
<td>11,564</td>
<td>2,211</td>
<td>19.1</td>
<td>8025.93</td>
<td>22,552.86</td>
</tr>
<tr>
<td>2004</td>
<td>14,290</td>
<td>2,813</td>
<td>19.7</td>
<td>10211.19</td>
<td>28,693.44</td>
</tr>
<tr>
<td>2005</td>
<td>10,225</td>
<td>2,435</td>
<td>23.8</td>
<td>8839.05</td>
<td>24,837.73</td>
</tr>
<tr>
<td>2006</td>
<td>8,203</td>
<td>1,796</td>
<td>21.9</td>
<td>6519.48</td>
<td>18,319.74</td>
</tr>
<tr>
<td>2007</td>
<td>10,885</td>
<td>2,090</td>
<td>19.2</td>
<td>7586.70</td>
<td>21,318.63</td>
</tr>
<tr>
<td>2008</td>
<td>7,658</td>
<td>1,964</td>
<td>25.6</td>
<td>7129.32</td>
<td>20,033.39</td>
</tr>
<tr>
<td>2009</td>
<td>16,102</td>
<td>3,367</td>
<td>20.9</td>
<td>12222.21</td>
<td>34,344.41</td>
</tr>
<tr>
<td>2010</td>
<td>14,345</td>
<td>2,675</td>
<td>16.6</td>
<td>9710.25</td>
<td>27,285.80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>118,477</strong></td>
<td><strong>24,060</strong></td>
<td><strong>20.77</strong></td>
<td><strong>87,337.80</strong></td>
<td><strong>245,419.22</strong></td>
</tr>
</tbody>
</table>

Source: Survey data. Exchange rate (US$ 1.00= ZMK 4,750.00)

From the graph in Figure 1, it was observed that January, March, April, July, August, September and December had high levels of whole liver condemnations (above 20%) while February, May, June, October and November had lower levels (below 20%).
Discussion

Findings from this study showed that fasciolosis is an important disease of cattle as it may be causing significant economic losses to the livestock industry as well as being a re-emerging zoonosis (Phiri et al., 2005). Western Province has the highest prevalence of fasciolosis in Zambia because the animals graze from the Zambezi flood plain almost seven months of the year (Mumba et al., 2011). Thus, local climatic conditions, local management practices and presence of the snail which is the intermediate host of *Fasciola gigantica* in the flood plains are probably the main factors influencing the incidence of the disease in this area.

From the current study it was observed that most of the cattle slaughtered in Senanga come from Shang’ombo which seems to have a relatively low prevalence of fasciolosis. This is probably due to the fact that there are less flood plains in Shang’ombo District. Furthermore, cattle farmers in Shang’ombo believe that the presence of a shrub in the district that is locally known as *kabulabula* (anecdotal evidence) that is browsed by ruminants reduce the worm burden. Authors suggest that studies be carried out on this shrub to determine its efficacy and anthelmintic activity on livestock. The above facts confound the actual prevalence of bovine fasciolosis in Senanga abattoirs in which animals from Shangombo District are also slaughtered.

January, March, April, July, August, September and December had high levels of (above 20%) liver condemnations. There were more slaughters in these months as this is the time when schools open so farmers sell their animals to pay school fees for children and meet other basic needs. December is a festive season in which Christmas falls; hence more slaughters are carried out contributing to high liver condemnation.

The level of liver condemnations seems to have drastically reduced (20.77%) in the 10 year period compared to 89.9% in 1973 (Silangwa, 1973) and 48% in 1998 (Pandey and Ahmedu, 1998). This could be due to increased levels of awareness and de-worming practices among farmers, improved and intensified extension work by the Government and other stakeholders and also increased accessibility to entities that supply drugs and veterinary services. The farmers also receive trainings on improved animal husbandry practices in the recent past.

In this analysis, only losses due to whole liver condemnations were considered. Losses arising from liver trimmings (partial condemnations) were not captured by this study. However, even if there is a reduction in livers being condemned compared to the past, the average annual losses amounting to approximately ZMK 1.2 billion (US$ 24,500) is enormous for the two districts and reduces farmer’s monthly incomes and loss in productivity of animals.

**Conclusion and Recommendations**

The results suggest that an average of 11,848 cattle are slaughtered annually in Senanga and Shang’ombo districts, with a total of 2,406 whole livers being condemned due to fasciolosis. This implies an annual loss of approximately US$ 24,500 for the 2 districts. Considering that large portions of Western,
Northwestern, Southern, Central, Northern Provinces and parts of many other countries in the region are flood plains and therefore equally prone to fasciolosis, these findings indicate that this disease condition may be causing significant socio-economic losses to the majority rural poor farmers who depend on livestock as their main source of income and livelihood. Therefore, the study recommends that there may be need for more effort in order to reduce the socio-economic losses that may be accruing from fasciolosis and other parasites. This can be achieved through regular effective deworming at least two to three times in a year using recommended drugs and rotational grazing.

References