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Abstract

The study was conducted from November, 2011 to March, 2012 at Dire Dawa municipal abattoir with the objective of determining the prevalence of bovine hydatidosis and to estimate the economic loss attributed to hydatid disease as the result of organ condemnation. A total of 432 animals were examined after slaughter for the presence of hydatid cyst in organs particularly, lung, liver, spleen, kidney and heart, using the standard routine meat inspection procedure. Of the 432 examined animals 139 (32.18%) were found to harbor hydatid cysts. The problem is more prevalent in older and female animals (P<0.05). However, no statistically significance variation was found between body condition and origin of animals (P>0.05). The total number of organs affected by one or more hydatid cyst(s) was found to be 184 out of which lungs account for 91 (49.5%), liver 84 (45.7%), spleen 4 (2.17), kidney 4 (2.17) and heart 1 (0.54%). Of the total of 757 hydatid cysts recovered and examined, 215 (28.4%), 383 (50.6%) and 159 (21%) cysts were fertile, sterile and calcified respectively. Moreover, from the total fertile cysts 34.9% confirmed to be viable cysts. The annual financial loss at Dire Dawa municipal abattoir was estimated to be about Ethiopian birr 362,617.39 (US Dollar 20,720.99). From the result obtained in this study, it can be concluded that hydatidosis is one of the most economically important cattle disease in the area warranting serious attention. Therefore, appropriate control and prevention measures need to be taken in order to minimize the economic loss associated with the problem and to prevent the zoonotic risk to the public health.

Key words: Abattoir, Cattle, Dire Dawa, Economic significance, Hydatidosis, Prevalence.

Introduction

The world human population is growing at a rate much faster than food production and this increase is mainly in developing countries, which are unable to assure adequate food for their people. Developing countries have nearly two third of the world’s livestock population, but produce less than a third of the world meat and a fifth of its milk1. Similarly, Ethiopia has the largest livestock population in Africa, with an estimated 49.3 million heads of cattle, 46.9 million sheep and goats, 7.55 million equines, and 2.3 million camels2. However, the contribution from these huge livestock resources to the national income is disproportionately small, owing to several factors draught or mal-nutrition, management problems, poor genetic performance and prevalent livestock diseases3. Among the prevalent livestock diseases, parasitism represents a major constraint to the development of livestock productivity in the country. Nevertheless,
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appropriate estimation of economic losses due to various parasitic diseases and adequate knowledge of the epidemiology is lacking.\textsuperscript{4,5}

Hydatidosis has a world wide geographical distribution and occurs in all continents. The distribution of \textit{E.granulosus} is higher in developing countries especially in rural communities where there is close contact between the dog, the definitive host, and various domestic animals, which may act as intermediate hosts.\textsuperscript{6,7} Hydatid disease is a problem in Asia, the Mediterranean, South America and Africa and also the prevalence of disease has increased in Europe and North America in recent years.\textsuperscript{9} In Africa \textit{E.granulosus} has been recorded from most countries.\textsuperscript{14,15} In Ethiopia, hydatidosis is the major cause of organ condemnation\textsuperscript{10,11,12,13}, causing huge economic losses. The epidemiology of hydatidosis various from one area to another so control measures appropriate in one area is not necessarily of valuable in another area.\textsuperscript{16}

In Ethiopia hydatidosis is one of the major parasitic zoonotic diseases especially where cattle, sheep, and goat are still slaughtered traditionally and offal’s are easily accessible to scavenging dog and other wild carnivores. Factor like absence of proper meat inspection procedure, poor management of food animals traditionally practices of back yard farming system, lack of awareness about food borne disease presence of large stray dog population are thought to be contribute significantly to the prevalence of the disease in Ethiopia.\textsuperscript{17}

Hydatidosis is a zoonitic parasitic infection of many mammalian species caused by the larval stage of \textit{Echinococcus granulosus}. Adult parasites are found in the small intestine of dog and other carnivores.\textsuperscript{18,19} The infective eggs containing the oncosphere passed in faeces are accidentally ingested by cattle, sheep, pigs other animals or human which act as intermediate hosts, the oncosphere in the eggs penetrate the intestine and reach the lever, lung and other organs including brain and muscles to develop in to hydatid cysts. The life cycle is completed when fertile hydatid cyst is eaten by a definitive host.\textsuperscript{20} The adult tape worm is comparatively harmless to the dog, although in large number enteritis may be seen.\textsuperscript{21,22,23} The pathogenesity of hydatid cyst depends on the severity of infection and organ in which it is situated and rapture of cyst may also cause total anaphylactic shock.\textsuperscript{24}

Cystic echinococcosis, though one of the most important helminth infection in man, has proved difficult to establish an accurate prevalence status in intimate hosts in any content. This is partly due to poor reliability of the available diagnostic tests and high costs of performing these tests under field conditions. Most of the prevalence studies have relied on slaughter data.\textsuperscript{25,26,27,28,29}

Various investigations have conducted abattoir surveys to determine the prevalence and economic importance of parasitic disease leading to condemnation of organs. Most of the surveys carried out in different abattoir of the country paid much attention to the parasitic causes.
of meat condemnation; mostly hydatidosis, cysticercosis and fasciolosis as they are usually considered to be the major economic and public health importance in meat inspection. However, periodic updating of such studies is important to know the progress of the problem.

**Materials and Methods**

**Study area**

The study was conducted at Dire Dawa municipal abattoir from November 2011 to April 2012. Dire Dawa administrative town is located approximately between latitude 9°27’ and 9°49’ North and longitude 41°38’ and 42°19’ East, at an elevation of 226-950m a.s.l. It shares boundary to the South, South-East and South-West with Eastern Hararghe zone of the Oromia regional state and the North, North-East and West with Shinile zone of Somali regional state.

In 2003, the total livestock population of Dire Dawa administration is estimated to be 66,346 cattle, 64,370 sheep, 112,065 goats, 19,206 camels 18085 equines and 72,000 poultry. Livestock are managed under small holder and intensive farming systems in the urban area and as extensive livestock production system in the pastoral area.

The total area of the administrative region is about 1288.02 km². The landscape comprises of mountains hills, valleys and river terraces, and flat plains. The existing land use comprises of 5.4% bush land, 32.8% shrub land, 4.8% grass land with rock, 0.2% intensively land, 18.5% moderately cultivated land, 36.1% bare soil/rock and the remaining 2.2% urban center.

The rainfall pattern is bi-modal with highest rainfall in July and August. The average annual rainfall varies from 700mm in the dry ‘Kola’ zone (hottest region) to 900mm in ‘Woinadega’ zone (coolest region). The monthly mean maximum temperature ranges from 28.1°C to 34.6°C recorded.

**Study animals**

The study animals were presented to the abattoir from November 2011 to March 2012 for slaughtering. From those animals which were brought to the municipal abattoir study animals were taken randomly and routinely inspected for hydatidosis. They were transported to the abattoirs usin vehicles and on foot. Almost all of the cattle slaughtered were brought from adjacent or nearby major livestock markets of different districts. Dire Dawa, Chlenko, Dawe, Kersa, Kulubi, Lange and Woter are the main livestock markets which serve as major source of animals for Dire Dawa municipal abattoir.

**Study design and sample size determination**

A cross sectional study was conducted from November 2011 to March 2012 at Dire Dawa municipal abattoir twice per week for the objectives of determining prevalence and economic significance of bovine hydatidosis in the study area. Cattle slaughtered during each visit day were randomly sampled and all the necessary data such as animal origin, age, breed,
body condition and organ affected was recorded. A total of 432 were selected by systematic random sampling method. The total number of cattle required for the study was calculated based on the formula given by Thrusfield (2005). By rule of thumb where there is no information about the prevalence of the disease in an area, it is possible to take 50% prevalence. Therefore the sample size was calculated based the following formula:

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

Where: 
- \( N \) = required sample size 
- \( p_{exp} \) = expected prevalence 
- \( d \) = desired absolute precision (5%)

So the calculated sample size was 384 cattle but 432 animals were included in the study, with the intention of maximizing the accuracy.

**Methodology**

**Abattoir survey**

Each week three days visit was made for ante-mortem inspection and post-mortem examination of slaughtered animals. All cattle slaughtered on each visit day were included. A total of 432 cattle were slaughtered in the abattoir during the survey period. During the ante mortem inspection, the age, sex, breed, origin, and body condition of each individual animal was assessed and recorded. Animal’s age was categorized into adult (≤5 year) and old (>5 year). The age estimation done by owners’ information and examination of teeth eruption using the approach forwarded by De Lahunta and Habel (1986). The method described by Nicholson and Butterworth (1986) for body condition scoring of zebu cattle was used. In the method described here for zebu cattle, three main conditions: fat (combining score 1-3), medium (6-9) and lean (7-9) were used instead of the nine scores. Animal origin was also recorded as Chelenko, Dawa, Dire Dawa, Kersa, Kulubi, Lange and Wotar by requesting information on origin of animals from the farmers or traders. Animals were identified based on enumerated marks on its body surface before slaughter using ink. Before conducting the postmortem examination, the identification markings done in the ante-mortem examination were transferred to all organs that are going to be examined by postmortem examination. Following a thorough visual inspection, palpation and systematic incision of each liver, lung, kidney, heart and spleen, all hydatid cysts found in these organs were collected to conduct cyst fertility test.

**Examination of cysts and checking the viability of protoscolices**

The infected organs from each positive animal were collected and the total number of hydatid cyst were counted per infected organ and recorded. The diameter of collected hydatid cyst was measured and classified as small (diameter <4 cm), medium (diameter between 4 and 8 cm) and large (diameter >8 cm) \(^{34,35,36}\). Of the collected hydatid cysts, individual content of the cyst was aspirated with a syringe to decrease its pressure and collected in a graduated beaker and the rest of the fluid was then added to it to measure its volume. The content was allowed to stay on incubator for 30 min at 36°C to settle the content and then about 10 ml of these sediments was
poured to the test tube and centrifuged at 1000 rpm for 3 minutes to separate the contents clearly from the liquid part. The supernatant was discarded and the sediment with some fluid was left in the test tubes. Examination was done under of 40X objective magnification for the presence/absence of protoscolex. The protoscolix which present as white dots on the germinal epithelium, or broad capsule or hydatid sand within the suspension cyst was defined as fertile. Fertile cysts were subjected to viability test. A drop of sediment containing the protosclerces were placed on the microscopic glass slide and covered with cover slip and observed for amoeboid like peristaltic movements with 40X objective. For clear vision a drop of 0.1% aqueous eosin solution was added to equal volume of protosclerces in hydatid fluid on microscope slide with the principle that viable protosclerces should completely or partially exclude the dye while the dead ones take it up. Furthermore, fertile cysts were characterized by their smooth inner lining usually with slightly turbid fluid in its content. Typical calcified cysts produce a gritty sound feeling upon incision.

Economic loss estimation

Direct and indirect losses were the basis of the estimation of the annual economic losses due to hydatidosis. Direct loss was calculated on the bases of condemned organs, whereas indirect losses were estimated on the basis of live weight loss hold by hydatidosis. Accordingly, the economic values of the loss from organ condemnations were evaluated by considering the following parameters. These include: information on the mean retail market price of the organs (lung, liver, spleen, kidney, and heart) at Dire Dawa town obtained from the butchers during study period, and the average annual slaughter rate of cattle at Dire Dawa municipal abattoir was estimated from the retrospective data of the last two years, and the loss from organs condemned was calculated by using the formula described by Regassa et al. (2010) as follows:

\[
\text{LOC} = (\text{NAS} \times \text{Ph} \times \text{Plu} \times \text{Cplu}) + (\text{NAS} \times \text{Ph} \times \text{Phr} \times \text{Cphr}) + (\text{NAS} \times \text{Ph} \times \text{Pli} \times \text{Cpli}) + (\text{NAS} \times \text{Ph} \times \text{Psp} \times \text{Cpsp}) + (\text{NAS} \times \text{Ph} \times \text{Pkid} \times \text{Cpkid})
\]

Where: LOC- loss due to organ condemnation

NAS- mean number of cattle slaughtered annually
Ph- prevalence of hydatidosis
Plu- percent involvement of lung
Cplu- current mean retail price of lung
Phr- percent involvement of heart
Cphr- current mean retail price of heart
Pli- percent involvement of liver
Cpli- current mean retail price of liver
Psp- percent involvement of spleen
Cpsp- current mean retail price of spleen
Pkid- percent involvement of kidney
Cpkid- current mean retail price of
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Likewise, the following parameters were considered to estimate the economic loss encountered from carcass weight losses:

- Information on the mean retail market cost of 1 kg beef at Dire Dawa town obtained from butchers during the study period.
- The average annual slaughter rate of cattle at Dire Dawa municipal abattoir estimated from retrospective data of the last two years.
- The average carcass weight loss of 5% due to hydatidosis.

Thus, the economic loss due to denied carcass weight gain was determined as described by Regassa et al. (2011) using the following formula:

\[ LCWL = NAS \times Ph \times CPB \times 5\% \times 126 \text{ kg} \]

Where:
- \( LCWL \) - loss from carcass weight loss
- \( 5\% \) - estimated carcass weight loss due to hydatidosis
- \( NAS \) - average number of cattle slaughtered animals
- \( Ph \) - prevalence of hydatidosis
- \( CPB \) - current average price 1 kg beef at Dire Dawa town
- \( 126\text{ kg} \) - average carcass weight (dressing percentage) of an adult Zebu cattle (Regassa et al., 2010).

Finally, the total economic loss was calculated by considering the loss from both organ condemnation and carcass weight loss. Thus:

\[ \text{Total loss} = LOC + LCWL \]

Data analysis

Raw data obtained was entered and stored in Microsoft Excel 2007 spreadsheet Computer program. The data were analyzed by using SPSS software windows version 17. A 95% confidence interval and 5% absolute precision was used to determine whether there was significance difference among hypothesized risk factors like sex, age, origin, body condition, and organ affected. Regarding to breeds, almost all the cattle presented to the abattoir in the study area were local zebu except 9 of them cross breeds; therefore comparison of infection rate was not made. P-value < 0.05 was considered as statistically significant in all cases.

Results

Abattoir survey

Prevalence study

The abattoir based bovine hydatidosis survey in the intermediate host (cattle) revealed that 139 (32.18%) of the total 432 cattle viscera examined had hydatid cyst. Rate of infection of
hydatidosis in different age groups (>5 and ≤5 years) was statistically significant (P<0.05). Out of 205 less than or equal to 5 years and 227 greater than 5 years old cattle, 50 (24.4%) and 89 (39.2%) were infected with hydatid cyst, respectively. Also the prevalence of hydatid cyst between sex of animals was observed statistically significant (P<0.05). Out of 298 males and 134 female cattle, 87 (29.2%) and 52 (38.8%) were infected with hydatid cyst, respectively (Table 2).

Table 2: Prevalence of hydatidosis on age, sex, and body condition basis.

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Number of examined animals</th>
<th>Number of positive animals</th>
<th>Relative prevalence</th>
<th>Chi-square (X²)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤5 year</td>
<td>205</td>
<td>50</td>
<td>24.4</td>
<td>10.837</td>
<td>0.001</td>
</tr>
<tr>
<td>&gt;5 year</td>
<td>227</td>
<td>89</td>
<td>39.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>432</td>
<td>139</td>
<td>32.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>298</td>
<td>87</td>
<td>29.2</td>
<td>3.913</td>
<td>0.048</td>
</tr>
<tr>
<td>Female</td>
<td>134</td>
<td>52</td>
<td>38.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>432</td>
<td>139</td>
<td>32.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lean</td>
<td>100</td>
<td>37</td>
<td>37.0</td>
<td>2.195</td>
<td>0.334</td>
</tr>
<tr>
<td>Medium</td>
<td>226</td>
<td>73</td>
<td>32.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>106</td>
<td>29</td>
<td>27.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>432</td>
<td>139</td>
<td>32.18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis of the occurrence of infection with regard to origin and body condition scoring were also made using proportions and described in table 3. The rate of infection with place of origin had shown an insignificant difference (P>0.05). However, animals originated from Woter had the highest prevalence (43.2%) while animals originated from Kersa and Lange were recorded as the least prevalence (25%). Also there was no statistical significance difference (P>0.05) between body condition of animals. In fact, the prevalence of cattle having lean body condition had slightly higher prevalence (37%), followed by medium (32.3%) and fat (27.4%) (Table 3).

Table 3: Prevalence of hydatidosis on origin basis.

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Number of examined animals</th>
<th>Number of positive animals</th>
<th>Relative prevalence</th>
<th>Chi-square (X²)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlenko</td>
<td>99</td>
<td>34</td>
<td>34.3</td>
<td>7.397</td>
<td>0.286</td>
</tr>
<tr>
<td>Dawe</td>
<td>54</td>
<td>14</td>
<td>25.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dire Dawa</td>
<td>64</td>
<td>21</td>
<td>32.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kersa</td>
<td>40</td>
<td>10</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kulubi</td>
<td>65</td>
<td>19</td>
<td>29.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lange</td>
<td>36</td>
<td>9</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woter</td>
<td>74</td>
<td>32</td>
<td>43.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>432</td>
<td>139</td>
<td>32.18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Organ distribution of hydatid cyst and cyst characterization

The postmortem examination revealed that the distribution of hydatid cysts on lungs, liver, spleen, kidneys and heart. The total number, relative prevalence and mean number of cysts harbored by each infected organ were described in table 4. Of the total 184 infected organs, the

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involvement of lung and liver accounted 91 (49.5%) and 84 (45.7%), respectively whereas spleen, kidney and heart were 4 (2.17%), 4 (2.17%) and 1 (0.54%), respectively (Table 4). Of the total 139 infected cattle, 54 (38.8%), 47 (33.8%), 34 (24.5%), 3 (2.2%) and 1 (0.7%) were infected with lung only, liver only, lung and liver only, lung, liver, spleen and kidney only and lung, liver, spleen, kidney and heart, respectively (Table 5). In general 101 (72.6%) were found involving only a single organ and the remaining 38 (27.4%) had multiple organ involvement.

Table 4: Distribution and number of organs with hydatid cysts in infected cattle.

<table>
<thead>
<tr>
<th>Organ</th>
<th>No. of Infected Organs</th>
<th>Relative prevalence</th>
<th>Cyst count</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean/organ</td>
<td>Range</td>
<td>Total</td>
</tr>
<tr>
<td>Lung</td>
<td>91</td>
<td>49.5</td>
<td>4.6</td>
<td>1-19</td>
<td>421</td>
</tr>
<tr>
<td>Liver</td>
<td>84</td>
<td>45.7</td>
<td>3.7</td>
<td>1-11</td>
<td>307</td>
</tr>
<tr>
<td>Spleen</td>
<td>4</td>
<td>2.17</td>
<td>4.8</td>
<td>1-5</td>
<td>19</td>
</tr>
<tr>
<td>Kidney</td>
<td>4</td>
<td>2.17</td>
<td>2.0</td>
<td>1-3</td>
<td>8</td>
</tr>
<tr>
<td>Heart</td>
<td>1</td>
<td>0.54</td>
<td>2.0</td>
<td>2</td>
<td>0.26</td>
</tr>
<tr>
<td>Total</td>
<td>184</td>
<td>100</td>
<td>4.1</td>
<td>1-19</td>
<td>757</td>
</tr>
</tbody>
</table>

A total of 757 cysts were collected from 184 infected organs. Out of the total hydatid cysts recovered in cattle 403 (53.2%) were small, 132 (17.4%) medium and 63 (8.3%) were large, and the rest 159 (21.0%) were calcified cysts. The rate of occurrence of small, medium and large cysts was higher in lung than liver. There were also large numbers of small, medium and large cysts in the lung than liver. However, the rate of occurrence of calcified cysts was higher in the liver than in the lung (Table 6).

Table 5: Distribution of hydatid cysts in organs of infected cattle.

<table>
<thead>
<tr>
<th>Affected organs</th>
<th>No. of infected organs</th>
<th>Relative frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung only</td>
<td>54</td>
<td>38.8</td>
</tr>
<tr>
<td>Liver only</td>
<td>47</td>
<td>33.8</td>
</tr>
<tr>
<td>Lung and liver only</td>
<td>34</td>
<td>24.5</td>
</tr>
<tr>
<td>Lung, liver, spleen and kidney only</td>
<td>3</td>
<td>2.2</td>
</tr>
<tr>
<td>Lung, liver, spleen, kidney and spleen</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>139</td>
<td>100</td>
</tr>
</tbody>
</table>

From the total of 757 hydatid cysts, 215 (28.4%), 383 (50.6%) and 159 (21.0%) were fertile, sterile and calcified cysts, respectively. Out of 215 fertile cysts, subjected for viability test, 75 (34.9%) were viable and 140 (65.1%) were non viable. The cyst condition in terms of organ involvement was found 134 (31.1%) fertile of which 48 (35.8%) were viable, 234 (55.6%) sterile and 53 (12.6%) calcified cysts in the lung. 74 (24.1%) fertile of which 24 (32.4%) were viable, 134 (44.7%) sterile and 99 (32.3%) calcified cysts in the liver. 4 (21.1%) fertile of which 1 (25%) were viable, 9 (47.4%) sterile and 6 (31.6%) calcified cyst in the spleen. 2 (25%) fertile of which 1 (50%) were viable, 5 (62.5%) sterile and 1 (12.5%) calcified cyst in the kidney. 1 (50%) fertile

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which is viable and 1 (50%) sterile, but there were no nonviable and calcified cysts recorded in the heart (Table 4).

**Table 6:** Cyst sizes and counts in relation with organ involvements.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Number (%) of the different cyst size</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small</td>
<td>Medium</td>
</tr>
<tr>
<td>Lung</td>
<td>228(54.2)</td>
<td>21(2.14)</td>
</tr>
<tr>
<td>Liver</td>
<td>157(51.1)</td>
<td>38(12.4)</td>
</tr>
<tr>
<td>Spleen</td>
<td>12(63.2)</td>
<td>1(5.3)</td>
</tr>
<tr>
<td>Kidney</td>
<td>4(50)</td>
<td>3(37.5)</td>
</tr>
<tr>
<td>Heart</td>
<td>2(100)</td>
<td>---</td>
</tr>
<tr>
<td>Total</td>
<td>403(53.2)</td>
<td>132(17.4)</td>
</tr>
</tbody>
</table>

**Table 7:** Status of hydatid cysts (fertile, sterile and calcified) in different organs of infected cattle.

<table>
<thead>
<tr>
<th>Organ</th>
<th>Viable No (%)</th>
<th>Nonviable No (%)</th>
<th>Subtotal No (%)</th>
<th>Sterile No (%)</th>
<th>Calcified No (%)</th>
<th>Total No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>48(11.4)</td>
<td>86(19.6)</td>
<td>134(31.8)</td>
<td>234(55.6)</td>
<td>53(12.6)</td>
<td>421(55.6)</td>
</tr>
<tr>
<td>Liver</td>
<td>24(7.2)</td>
<td>50(16.2)</td>
<td>74(24.1)</td>
<td>134(44.7)</td>
<td>99(32.3)</td>
<td>307(40.6)</td>
</tr>
<tr>
<td>Spleen</td>
<td>1(5.3)</td>
<td>3(15.8)</td>
<td>4(21.1)</td>
<td>9(47.4)</td>
<td>6(31.6)</td>
<td>19(2.5)</td>
</tr>
<tr>
<td>Kidney</td>
<td>1(12.5)</td>
<td>1(12.5)</td>
<td>2(25)</td>
<td>5(62.5)</td>
<td>1(12.5)</td>
<td>8(1.1)</td>
</tr>
<tr>
<td>Heart</td>
<td>1(50)</td>
<td>---</td>
<td>1(50)</td>
<td>1(50)</td>
<td>---</td>
<td>2(0.26)</td>
</tr>
<tr>
<td>Total</td>
<td>75(9.9)</td>
<td>140(18.5)</td>
<td>215(28.4)</td>
<td>383(50.6)</td>
<td>159(21.0)</td>
<td>757</td>
</tr>
</tbody>
</table>

**Estimation of economic loss**

*Economic loss due to organ condemnation*

A total of 91 lungs, 84 livers, 4 spleens, 4 kidneys and 1 heart were condemned due to hydatidosis with an economic loss of EtB 11834.94, 48966.34, 75.72, 1211.54, and 168.27 respectively. This was calculated from average market price of cattle cattle lung (birr 10), liver (birr 45), cattle spleen (birr 1.50), cattle kidney (birr 24) and cattle heart (birr 15) and the total number of organs condemned during the study period. On the other hand, annual economic loss was determined by considering annual slaughter rate of cattle and prevalence of hydatidosis per lung, liver, spleen, kidney and heart. And it is calculated to be EtB 62256.81 annually.

*Economic loss due to carcass weight*

A 5 % carcass weight loss due to hydatidosis (Regassa et al., 2010) was considered as the information given previously to estimate the economic loss. The computed result showed a loss of EtB 300,360.58 per annum.
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Therefore, the total estimated economic loss in cattle at Dire Dawa municipality abattoir due to hydatidosis was estimated to be EtB 362,617.39 (which is equivalent to USD 20,720.99; 1USD = 17.5 EtB)

Discussion

The current study revealed that the overall prevalence of bovine hydatidosis at Dire Dawa municipal abattoir was found to be 32.18%. This prevalence is higher than the reports of Kebede et al. (2008a), Tsegaye (1995), Mersie (1993), Njoroga et al. (2007) and Ulutas et al. (2007) which are 15.2% in Northwestern Ethiopia, 7.2% in Debre Brhan, 20.5 in Eastern Ethiopia, 19.4% in Turkana Kenya and 16.6 in Turkey respectively. However, this finding is in agreement with the findings of Ahmed (1988) 33.66% in Jimma, Mersie (1985) 32-33% in Wolalla Sodo, Berhe (20010) 32.11% in Mekelle, Yhidego (1997) 32.12% in Mekelle, Regassa (1987) 32.19 in Nekemte, Toncheva and Zhelduaskov (1999) 29% in Bulgaria and Arene (1985) 31.6% in Niger. Higher prevalence of hydatidosis than the present studies were also reported by Sinshaw (1988) 63% in Bale Robe, Gesese (1990) 59.9% in Bahir Dar, Ernest et al. (2001) 48.7% in Ngorongoro, Tanzania and Larrieu et al. (2001) 82% in Argentina.

The prevalence may however vary from country to country or even within a country. In general terms, throughout the world, there had been different magnitude records of hydatidosis in cattle with low, medium and high rates of occurrences. Generally the variation in prevalence rate among different geographical locations could be ascribed to the strain differences of Echinococcus granulosus that exists in different geographical locations. Additionally variability could be related with age factors. Other factors like different in culture, social activities and attitudes to dogs indifferent region may contribute to variation.

The prevalence rate of 32.18% in the study area was high. This might be due to the abundance and frequent contact between the infected intermediate and final hosts. It could also be associated to slaughtering of aged cattle which have had considerable chance of exposure to the parasitic ova, backyard slaughtering of small ruminants and provision of infected offal’s to pet animals around homesteads. Moreover, poor public awareness about the disease and presence of few slaughterhouses could have contributed to such a higher prevalence rate.

With regards to rate of infection of hydatidosis in different age groups of cattle, significant difference (P<0.005) was observed. Animals with more than 5 years of age were highly affected. Some previous studies conducted suggest that the prevalence of bovine hydatidosis is heavily influenced by age (Lahmar et al., 2001).The difference in infection rate could be mainly due to longer exposure time to E. granulosus. This finding is similar to the finding of Lobago (1994), Yihdego (1997), Umur (2003), Azlaf and Dakkak (2006) and Esatgil and Tuzer (2007).

Analysis of risk factor showed that sex of animals had significance association with the occurrence of the disease. Female animals, have higher odds to acquire the disease than male animals. The explanation behind is that, female animals are not slaughtered in younger ages as long as they are fertile. They are sent to abattoirs after milking and getting calves or for years.

Therefore, the chance of catching an infection in females increases as the animals aging. This finding is similar with the finding of Kara et al. (2009).

In this study, the prevalence of hydatidosis was slightly higher in cattle having lean (poor) body condition (37%) followed by medium (32.3%) and fat (good) (27.4%). The poor body condition in such animals is probably a reflection of the effect of relatively high cyst burden. This finding is in agreement with the findings of Kebede et al. (2009d) and Berhe (2010). Battli (1997) reported that moderate to severe infection with the parasite may cause retarded growth and performance, reduced quality of meat and milk as well as reduced live weight.

Analysis was made to establish relationship between animal origin and prevalence of the disease and it was not significantly related (P > 0.05). This may be due to difficulty in getting exact origin of the animals and exchanging of the animals in local markets. This result contradict with that of Yetnayet (2010) who reported that there is significant co-relation between bovine hydatidosis and animal origin; that could be due to difference in social activity, attitude to dogs and climate in different regions.

It has been established that hydatid cyst occur predominantly in lungs and liver. Immature parasites have no selective affinity for any particular organ, and location of hydatid cyst in animal is controlled by filtering action of capillaries. This could be due to the fact that lungs and liver possesses the first great capillaries sites encountered by the migrating Echinococcus onchosphere (hexacanth embryo) which adopt the portal vein route and primarily negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved, but onchospers which traverse these will reach the systemic circulation and hydatids have been found in many organs and tissues. The study revealed that hydatid cysts occur predominantly in the lung and liver, and occasionally in spleen, kidney and heart. From the total of 184 infected viscera about 175 (95.2%) were due to overall involvement of lung and liver. This finding is in agreement with the work reported by Kebede et al. (2009b) and Regassa et al (2010). The fact that hydatid cysts showed greater preference for lung and liver than other viscera could be ascribed to presence of the dense capillary networks in these organs which filter out and retain the oncosphere of Echinococcus granulosus before being encountered by peripheral organs.

Higher number of medium and large sized cysts was found in the lung than other organs, while the liver harbored higher number of small sized and calcified cysts. The occurrence of large number of medium and large sized cysts in lung than other organs is attributed to the relatively softer consistency of lungs allowing easier development of the pressure of cyst (Smyth, 1985). On the other hand, the higher number of calcified cyst in the liver could be due to presence of relatively higher number of reticuloendothelial cells and abundant connective tissue reaction of the organ. Likewise, the high amount of small cysts may be associated with immunologically response of the host, which might prohibit expansion of cyst size. During examination of the cyst condition, the finding of 69.15% sterile, 3.48% fertile and 27.36% calcified cysts were examined. It may generally imply that most of the cysts in cattle are infertile, in Britain up to 90% total cysts from cattle are said to be sterile. The variation in fertility
rate among different species and in different geographical zone could be due to the difference in strain of *E. granulosus*.\textsuperscript{3,15,25} When we compare the fertility rate among the organs, it was higher in lung than liver. This is due to lung has been relatively softer consistent tissue which allows the easier development of the cyst and the fertility rate of hydatid cysts may show a tendency to increase with advancing age of the hosts. This may be attributed probably due to reduced immunological compatibility of animals at their older age of infection. The variation between tissue resistances of the infected organs may also influence the fertility rate of hydatid cyst\textsuperscript{24}.

The present study was emphasized to carry out any assessment on annual economic loss due to bovine hydatidosis at Dire Dawa municipal abattoir. Losses from offal condemnation and carcass weight loss in affected cattle were assessed and estimated at EtB 362,617.39 (USD 20,720.99). Such loss is of particular importance in Ethiopia, which has low economic output. Different economic losses regarding bovine hydatidosis were also reported from different part of the country. Roman (1987) EtB 90,644.95 in Gondar, Daniel (1995) EtB 215,000 in Dire Dawa, Hagos (1997) EtB 129,934 in Mekelle, Moges (2003) EtB 131,190.45 in Jimma and Miruk (2005) EtB 192,208.45 in Asella were lower financial loss than this study. Also there were greater than the current estimation loss, for instance, Terefe (2010) EtB 19,847,704.5 and Melaku (2011) EtB 681,333.87 that have done in Addis Ababa and Dessie respectively. The difference in economic loss estimated in various abattoirs/regions may be due to variation in the prevalence of the disease, mean annual number of cattle slaughtered in different abattoirs, and variation in the retail market price of organs in different regions. According to Polypedrus (1981), in addition to the losses incurred in the abattoir, hydatidosis could have economic impact due to invisible losses like impaired productivity, for example, reduced traction power which results in reduced crop yield.

**Acknowledgments**

We thanks to the university of Gondar for its funding to this research project and all the staff members of the Dire Dawa regional laboratory and municipal abattoir for their willingness and kindness to give us unreserved assistance of the laboratory equipments and their technical support during the study.

**Reference**

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70. Roman, T., 1987. Study on economic significance of fasciolosis and hydatidosis at Gondar abattoir. DVM thesis Faculty of Verterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.


Hydatidosis: Prevalence and Economic Significance in Cattle in Ethiopia

79. Tsegaye, M., 1995. Epidemiology of bovine fasciolosis and hydatidosis in Debre Brhan region. DVM thesis, Faculty of Veterinary Medicine, AAU, Debrezeit, Ethiopia.


List of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>a.s.l</td>
<td>above sea level</td>
</tr>
<tr>
<td>AAU</td>
<td>Addis Ababa University</td>
</tr>
<tr>
<td>AE</td>
<td>Alveolar Echinococcosis</td>
</tr>
<tr>
<td>CDC</td>
<td>Centre for Disease Control</td>
</tr>
<tr>
<td>CE</td>
<td>Cystic Echinococcosis</td>
</tr>
<tr>
<td>CFT</td>
<td>Compliment Fixation Test</td>
</tr>
<tr>
<td>CSA</td>
<td>Central Statistical Agency</td>
</tr>
<tr>
<td>DDASA</td>
<td>Dire Dawa Administrative Statistical Abstract</td>
</tr>
<tr>
<td>DDRAB</td>
<td>Dire Dawa Administration Regional Agricultural Bureau</td>
</tr>
<tr>
<td>EtB</td>
<td>Ethiopian Birr</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agricultural Organization</td>
</tr>
<tr>
<td>FVM</td>
<td>faculty of Veterinary Medicine</td>
</tr>
<tr>
<td>ILRI</td>
<td>International Livestock Research Institution</td>
</tr>
<tr>
<td>OIE</td>
<td>Office International des Epizootics</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Science</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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