Study on Cattle Fasciolosis and Hydatidosis at Adama Municipal Abattoir, Eastern Ethiopia: Prevalence and Economic impact

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Abstract: Cross sectional study was conducted between December, 2009 and April, 2010 with the objective of determining the prevalence of hydatidosis and fasciolosis, identifying major causes of organ condemnation and estimating direct financial losses due to organ condemnation associated with fasciolosis and hydatidosis in cattle slaughtered in Adama Municipal Abattoir, Eastern Ethiopia. Detailed post mortem meat inspection procedures were employed to detect the pathological lesions in 300 cattle. Nearly seven in ten cattle were found affected with one or more of pathological lesions. Overall, 358 different organs were condemned with liver being the highest 151(42.2%). Hydatidosis was the leading cause (53.5%) for organ condemnation. Fasciolosis and hydatidosis were the leading causes of condemnation for liver and lungs, respectively. Overall, 97/300 (32.3%) (95% CI: 27%, 37%) and 146/300(48.7%) (95% CI: 43%, 54%) of cattle were found harboring fasciola and hydatid cyst, respectively. An estimated annual direct financial loss from condemnation of organs associated with hydatidosis and fasciolosis was 39,868.00 Ethiopian Birr (ETB) and 87,210.00 ETB, respectively contributing for total monetary losses of 127,078.00 ETB (approximately $5776.27 USD).
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***Key words*:** Cattle, Fasciolosis; Financial loss, Hydatidosis, Organ condemnation, Pathological lesions, Prevalence

1. Introduction

Fasciolosis and hydatidosis are the important parasitic diseases of livestock that have both financial and public health significance. They are associated with severe morbidity and disability, and are the world's most geographically widespread zoonotic diseases.

Fasciolosis is an important helminth disease caused by two species of trematodes *Fasciola hepatica* (the common liver fluke) and *Fasciola gigantica.* This disease belongs to the plant-born trematodes zoonosis (Mas-Coma *et al*., 2005). The definitive host range is very broad and includes many herbivorous mammals, including humans. The life cycle includes freshwater snails as an intermediate host of the parasite (Torgerson and Claxton, 1999). In Ethiopia, *F. gigantica* is found at altitudes below 1800 m.a.s.l. and *F. hepatica* is found at altitude between 1200-2560 m.a.s.l (Yilma and Malone, 1998). Mixed infections by both species can be encountered at 1200-1800 m.a.s.l (Periago *et al*., 2008). In Ethiopia, various reports suggest that fasciolosis is a highly prevalent disease (Yimam, 2003), where livestock represent the pillar of the local economy and plays a vital role in livelihood of the farming communities (Mulualem, 1996). The financial significance of fasciolosis in the highlands of Ethiopia has been reported by several workers (Yilma, 1985; Yadeta, 1994; Mezgebu, 1995; Wassie, 1995). In Ethiopia, farmers loose an estimated at 48.8 million Ethiopian birr/annum worth of production (Mulugeta *et al.,* 1989).

Echinococcosis/hydatidosis is a zoonosis caused by adult or larval (metacestode) stage of Cestodes belonging to the genus Echinococcus (family Taeniidae) (Schantz *et al*., 2006). Two major species of veterinary and public health importance are *E.granulosus* and *E. multilocularis* that, respectively, cause cystic echinococcosis (CE) and alveolar echinococcosis (AE). Both CE and AE are serious and severe diseases, the latter especially so, with high fatality rates and poor prognosis if managed incorrectly. Unilocular hydatid disease, hydatidosis, caused by the larval stage of *E.granulosus* is recognized as being one of the world's major zoonosis (Smith, 1976). In Ethiopia several reports indicate that hydatid cyst is prevalent in livestock. However, the status of hydatidosis in animals is not well documented and explored in the country. Therefore, knowledge on the prevalence and financial lose due to condemnation of carcases caused by these parasites

would be of prime importance in targeting an effective control scheme in the country.

2. Materials and Methods

Study Area: The study was conducted in Adama municipal abattoir located in Adama town. Adama district is located in the East Shewa Zone of Oromia regional state with latitude of 8°33'N 39°16'E and longitude of °N 39.27°E having an elevation of 1712 meters above sea level situated at a distance of 99 km Southeast of Addis Ababa. It has an estimated human population of 228,623 whereby males and females are accounting for 114,255 and 114,368, respectively (CSA, 2005). Its average annual rainfall is 760 mm while the average monthly ambient temperature is 21°c. Its livestock population comprises 61,069 cattle, 36,142 sheep, 42,968 goats, 286 equines, 14 camels and 201,196 poultry.

Study Animals: The study cattle were local zebu cattle (Bos indicus) which were brought to Adama municipal abattoir for slaughter from the surrounding areas like Arsi, Bale, Afar, Harar, and Borena areas. Most of these cattle were males having 4 years of age and above which had entered in the feedlots late in their life. The town has one municipality abattoir that supplies the inspected meat to more than 150,000 inhabitants and 82 legally registered butcheries. On average, 60 heads of cattle are slaughtered per day in this abattoir starting from midnight.

Study Design and Sample Size: A cross sectional survey was used for determining the prevalence of fasciolosis and hydatidosis. A systematic random sampling procedure was used to select the cattle considering the prevalence 20%at a 95% level of confidence and a 5% level of significance (Thrusfield, 2007). The sample size was calculated 246 but increased to 300 for strengthening precision.

Detailed Post-Mortem Abattoir Inspection: Detailed post-mortem inspection was used to investigate the presence of any lesions in visceral organs like liver, lungs, spleens, kidneys, and hearts involving visualization, palpation and incision.

Estimation of Direct Financial Losses: The direct financial losses due to both fasciolosis and hydatidosis associated with organ condemnation were roughly calculated on a yearly basis. The average cattle slaughter rate (Sr) at the slaughterhouse for the last two years was determined from the data record and utilized for both computations. Financial losses because of fasciolosis (A) was calculated based on the condemnation rates of cattle liver (Rc) and average cost of each cattle liver (C_L) according to the following formula (Ogunrinade and Ogunrinade, 1980):

$$\mathbf{A = \Sigma (Sr \; X \; C_L \; x \; Rc)}$$

Whereas, the monetary loss due to hydatidosis (B) was computed using the average cattle slaughter rate (Sr), the mean prevalence of hydatidosis (Ph), percent involvement of organs (Io) and the mean retail price of an organ. It was worked out according to Jobre et al., 1996 as:

$$\mathbf{B = \Sigma (P_h \; x \; S_r \; x \; I_o \; x \; Co)}$$

Finally, the overall financial losses due to fasciolosis and hydatidosis were calculated as the sum of the losses because of the two factors as A + B.

Data Analysis: Raw data from post mortem inspection was entered into Microsoft Excel which was then transferred to SPSS. Percentages were used to summarize the data and confidence interval was used for parameter estimation. The prevalence of fasciolosis and hydatidosis was obtained as proportion of cattle with the respective lesion to total cattle examined. Rate of organ condemned was computed as the number of specific organ condemned to total organs condemned.

3. Results

Organ Condemnation: Out of total cattle slaughtered, 206/300 (68.7%) of them were found with one or more of pathological lesions as determined by detailed postmortem inspection. Overall, 358 different organs were condemned with liver being the most 151(42.2%) condemned organ followed by 150 (42.0%) lungs, 8(2.2%) spleens, 22(6.1%) kidneys, and 27(7.5%) hearts. Hydatidosis (53.5%) was the leading cause of organ condemnation.

Fasciolosis was the commonest causes of liver condemnation (64%) followed by hydatidosis (24.5%), calcification (8%) and cirrhosis (3.5%). Likewise, the major reason for lung condemnation was hydatidosis (85.3%) followed by, emphysema (6%), pneumonia (5.3%) and tuberculosis (3%). Hydatidosis also found to be a factor for condemnation of spleen, kidney and heart, though; calcification, Cystiecercus bovis and pericarditis were additional causes of condemnation for the latter (Fig. 1).

Prevalence of Fasciolosis: Out of the total cattle examined, 97/300 (32.3%) of them were found infected with fasciolosis. Liver was observed to be affected highly both by fasciola and hydatid cysts but the relative infection rate due to 26 fasciolosis is by far greater than hydatidosis (Fig.2).

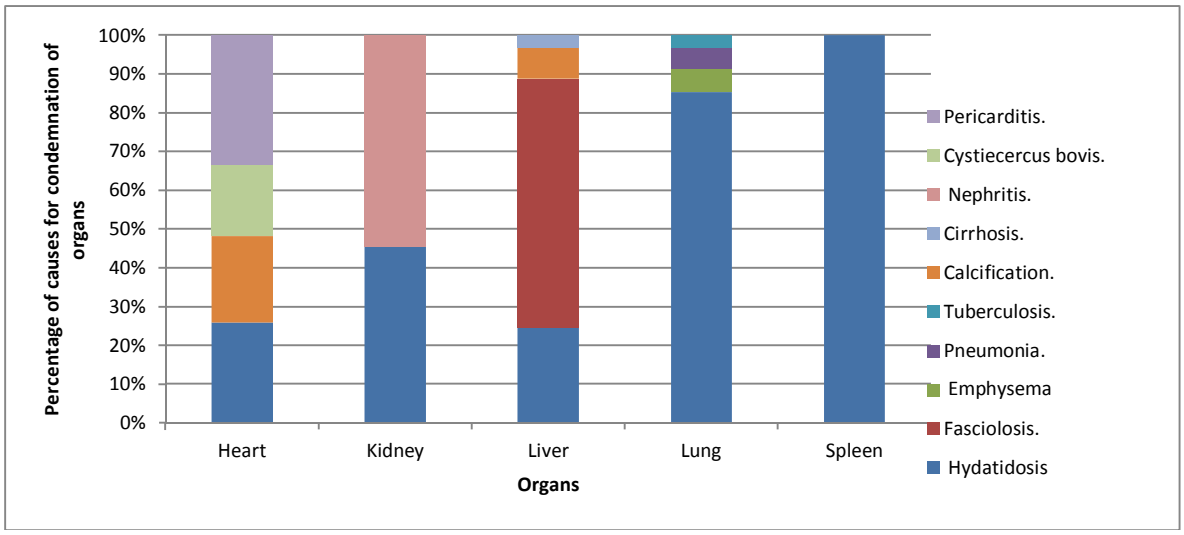

Figure 1. Percentages of causes of organs condemnation: Adama Municipal Abattoir, Ethiopia, 2009 December-2010 April

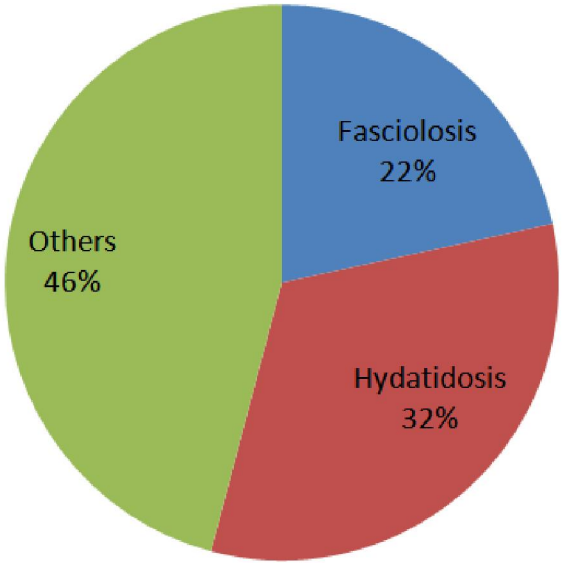

Figure 2. Distribution of fascolosis, hydatidosis and other pathological lesions: Adama Municipal Abattoir, Ethiopia, 2009 December-2010 April

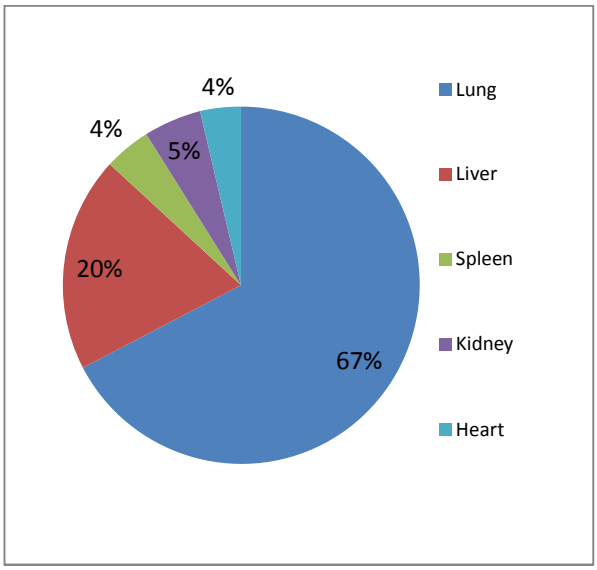

Figure 3. Hydatidosis distribution in organs of slaughtered cattle: Adama Municipal Abattoir, Ethiopia, 2009 December-2010 April

Prevalence of Hydatidosis: The study revealed that 146/300 (48.7%) of cattle examined in post mortem had hydatid cyst whereby in 103/146 (70.5%) of them only a single organ was affected whilst in the remaining 43/146 (29.5%) multiple organs were involved. Lung and liver constitutes 165/190(86.8%) of the organs affected by hydatid cyst each accounting for 128/190 (42.7%) and 37/190 (12.3%), respectively. The distributions of hydatid cyst in organs of infected cattle summarized in Fig. 3 and 4.

Estimation of Direct Financial Losses: The direct financial losses due to both fasciolosis and hydatidosis were roughly calculated on a yearly basis. The average cattle slaughter rate (Sr) at the slaughterhouse was 13,500 for the last two years as determined from the data registry which was utilized for both computations. To proceed for financial losses because of fasciolosis (A) the condemnation rates of cattle liver (Rc) and average cost of each cattle liver (C_L)

which is 32.3% and 20.00 Ethiopian Birr (ETB), respectively were used and calculated as:

A = Σ (Sr X C_L x Rc) = (13500 x 20.00 x 32.3%) =87,210.00 ETB.

Similarly, the monetary loss due to hydatidosis (B) was computed using the average cattle slaughter rate (Sr), the mean prevalence of hydatidosis (Ph) = 48.7%, percent involvement of organs (Io) with proportions lung (67.4%), liver (19.5%), spleen (4.2%), kidney (5.3%) and heart (3.6%), and the mean retail price of an organ (Co) in Ethiopian Birr including lung (5.00), liver (20.00), spleen (2.00), kidney (20.00) and heart (5.00). It was worked out with the following formula:

$B = \Sigma (P_h \times S_r \times I_o \times Co)$

B = (48.7% x 13,500 x 67.4% x 5.00) + (48.7% x13, 500x19.5% x 20.00) + (48.7% x13, 500 x 4.2% x 2.00) + (48.7% x13, 500 x 5.3% x 20) + (48.7% x13, 500 x 3.6% x 5)

B = 5,522.58 + 25,640.55 + 552.26 + 6,968.97 + 1,183.41= 39,867.77 ETB

Ultimately, the overall financial losses due to fasciolosis and hydatidosis were calculated as the sum of the losses because of the two factors as A + B yielding **127,078.00 ETB (approximately $5776.27 USD).**.

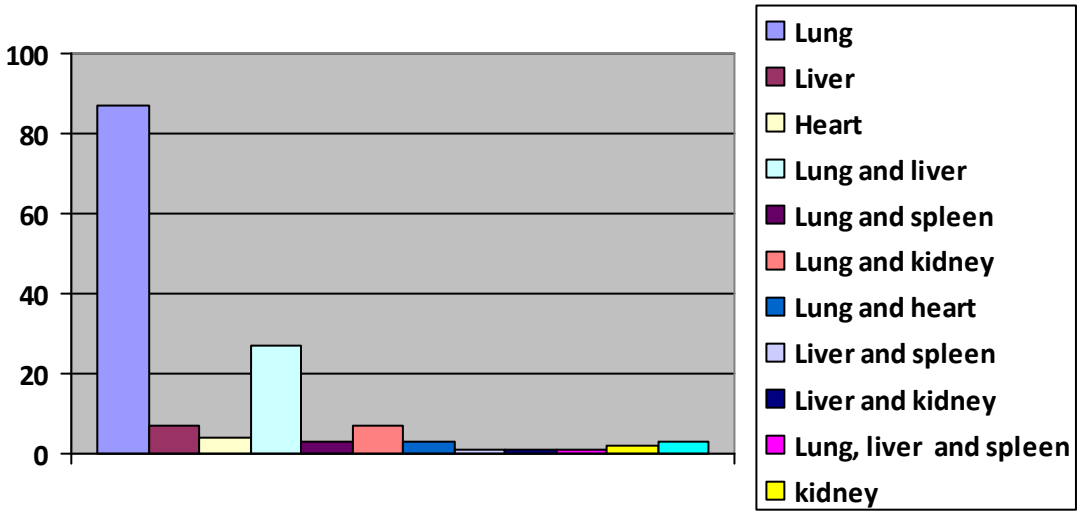

Figure 4. Hydatidosis distribution in the slaughtered cattle: Adama Municipal Abattoir, Ethiopia, 2009 December-2010 April

4. Discussions

In the present study, 32.3% prevalence of fasciolosis was recorded. This finding was comparable with previous findings obtained in Ethiopia. Adem, (1994) reported the prevalence of 30.2 % in cattle when he conducted a preliminary survey to study fasciolosis prevalence in cattle and sheep around Zeway, Ethiopia. Yimam, (2003) showed prevalence of 33.42 % through his survey on the major causes of organ condemnation in ruminants slaughtered at Gondar abattoir, North West Ethiopia.

In contrast to these findings, higher prevalence of fasciolosis was reported in different parts of Ethiopia. Gamechu and Mamo, (1979) reported 86% in Keffa, southern Ethiopia. Brook *et al*. (1985) reported prevalence of 88.6% in Debre Berhan, one of the well known high land area of the country. Yilma, (1994) demonstrate prevalence of 49 % during his study on epidemiology of bovine and ovine fasciolosis, and distribution of its snail intermediate host in Holeta, Western Shoa. The reasons for the variations of these results with the current finding might be attributed to the existence of environmental factors such as high rain fall, acid soil, abundant water logged, and marshy areas favoring propagation and maintenance of infection in the snail intermediate host. The husbandry system which influences the grazing habits and breed of the host might also be the possible reasons (Urquhart *et al*., 1996).

Out of the total liver condemned, 17 (11%) was attributable to calcification and cirrhosis which might be due to chronic fasciolosis. Financial loss estimated due to liver condemnation was on average 87,210.00 ETB/year and 6.46 ETB per slaughtered animal. Therefore, the current finding indicated that fasciolosis was prevalent and caused significant financial loss from liver condemnation in the study area. This estimate does not actually include the great majority of cattle slaughtered at backyard. Therefore, the crude estimate was actually far lower than the real

financial loss calling for further investigations to well understand the real losses.

The occurrence of hydatidosis in cattle during the study period was found to be 48.7%. This finding is comparable with the finding of Jobre *et al*., (1996) who had reported the prevalence rate of 46.5% in cattle slaughtered in Gondar abattoir. Almost all of the slaughtered animals in Adama abattoir were old and hence they were exposed to the disease (parasitic ova) over a long period of time with an increasing possibility of acquiring the infections. Wide variation of hydatidosis prevalence was recorded in different parts of the country (Ulutas *et al*., 2007). Prevalence ranging from 7.2% to 75.1% was reported in Ethiopia by Tsegaye, (1995) and Roman, (1987) respectively. The variations in prevalence among different geographical locations could be ascribed to the strain differences of *E.granulosus* that exists in different geographical locations (McManus, 2006). Additionally variability could be related with age factors. Other factors like difference in culture, social activities and attitudes to dogs in different region may contribute to variation (Arbabi and Hooshyr, 2006).

In the present study, hydatid cysts occurred predominately in the lung and liver with prevalence rate of 86.8%. This is explained by the fact that lungs and livers possess the first great capillaries sites encountered by the migrating Echinococcus oncosphere (hexacanth embryo) which adopt the portal vein route and primarily negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved. In addition, the lungs were mostly infected than any other organ this might be due to the fact that ruminants are slaughtered at older age. At this particular period the liver capillaries are dilated as the result it makes easy access for the cysts to the lung and exacanth embryos to enter the lymphatic circulation and carried to the heart and lungs, then the lungs may be infected before or instead of the liver. Arene, (1985), Mitiku, (2007) and Zeleke, (2008) reported similarly that the lungs were more affected than liver in aged animals.

Higher numbers of medium and large sized cysts were found in lungs of cattle than in the liver while the liver harbored higher number of small sized and calcified cysts. The reason for higher percentage of medium and large cysts in the lungs is due to softer consistency of the lung while the higher yield of calcified cysts in liver could be attributed to relatively higher reticuloendothelial cells and abundant connective tissue reaction of the organ. The high proportion of small cysts may be due to immunological response of the host which might preclude expansion of cyst size (Torgerson *et al*., 1998; Lahmar *et al*., 1999; Larrieu *et al*.,2001; Torgerson, 2002).

The rough estimation of annual financial loss due to organs condemnation caused by bovine hydatidosis in Adama slaughter house is 39,868.00 ETB/year and 2.95 birr per slaughter animal. This estimate does not actually include the great majority of cattle slaughtered at backyard. Therefore, the crude estimate was actually far lower than the real financial loss. This needed further researching.

The current findings indicated that hydatidosis and fasciolosis were prevalent and caused significant financial losses from organ condemnation in the study area. Seven in ten of the slaughtered cattle were with lesions. More than half and nearly quarter of organ condemnation was attributable to hydatidosis and fasciollosis, respectively. Liver was the most condemned organ followed by lungs. Fasciolosis and hydatidosis were the leading causes of condemnation for liver and lungs, respectively. In conclusion, hydatidosis and fascolosis were prevalent in the studied area causing considerable organ condemnations necessitating practical intervention strategies to mitigate the problems.

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