

## Study on Zoonotic Metacestodes of Cattle Slaughtered at Bahir Dar Municipal Abattoir, Northwest Ethiopia

*Birhanu Mekbib, Habtamu Abesha and Dawit Tesfaye*

Hawassa University, School of Veterinary Medicine, Hawassa, Ethiopia

**Abstract:** A cross sectional study was conducted from November 2010 to March 2011 to estimate the prevalence of the major metacestodes of cattle slaughtered at Bahir Dar municipal abattoir. Out of 465 randomly selected slaughtered cattle, 12 (2.58%) and 148 (31.8%) were infected with *Cysticercus bovis* and Hydatid cyst, respectively. The prevalence of *Cysticercus bovis* was significantly different between castrated and uncastrated cattle. However, there was no significant difference for the prevalence of *Cysticercus bovis* among the different origins and management systems ( $p>0.05$ ). There was also no marked difference in the prevalence of hydatid cyst in cattle among the different origins ( $p>0.05$ ). In contrast, the difference in the prevalence of the hydatid cyst between the different management system was found to be statistically significant ( $p<0.05$ ). Similarly, the prevalence of hydatid cyst was statistically significant between castrated and uncastrated cattle ( $p<0.05$ ). Regarding organ distribution, tongue and masseter muscle were the most frequently infected organ with *Cysticercus bovis*. Whereas, lungs took the highest proportion among the other organs infected with hydatid cyst. The viability test of the metacestodes of cattle showed that 33.9 % of *Cysticercus bovis* and 20% of the examined hydatid cyst were viable. In a nut shell, the finding of the present study reflects a visible reduction in the prevalence of *Cysticercus bovis* from the previous years and still a higher prevalence in hydatid cyst. Therefore, serious attention should be given by various stake holders to break the life cycle of both metacestodes and hence reduce their impact on the public health.

**Key words:** Metacestode • Cattle • Prevalence • Abattoir • Bahir Dar

### INTRODUCTION

Bovine cysticercosis, refers to the infection of cattle with metacestodes of the human tapeworm *Taenia saginata* [1, 2]. Bovine cysticercosis is a major problem for producers in sub Saharan Africa. The clinical effect of cysticercosis on infected animal is generally not significant, however, in addition to the effect on human health, economic losses may be high due to the condemnation of heavily infected carcasses and the necessity to freeze or boil infected meat, restriction of export and herd quarantine [3, 4].

Hydatidosis is a zoonotic infection caused by adult or larval stage of cestode belonging to the genus *Echinococcus*. Hydatid disease (Hydatidosis) is characterized by cyst containing numerous tiny protoscolices that most often develop in the liver and

lungs and also develop in the kidneys, spleen, nervous tissue, bone and other organs [5].

Both bovine cysticercosis and hydatid cysts are considered as an important public health and economic problem in most developing countries including Ethiopia [6]. In some literatures hydatidosis is considered as one of the world's most geographically widespread zoonotic diseases. The pathogenicity of hydatidosis heavily depends on the extent and severity of infection and the organ on which it is situated. The occasional rupture of hydatid cysts often leads to sudden death due to anaphylaxis, hemorrhage and metastasis [7]. *Taenia saginata* infestation in human is accompanied with mild symptoms ranging from nausea, abdominal discomfort, epigastric pain, diarrhea, vitamin deficiency, excessive appetite or loss of appetite, weakness and loss of weight to digestive disturbances and intestinal blockage [8].

Although there was some research works carried out in certain parts of the country, the status of metacestodes in livestock were not fully studied in Bahir dar. Therefore, the study was targeted to fill the information gap about the zoonotic metacestodes in cattle.

## MATERIALS AND METHODS

**Study Area:** The study was conducted at Bahir dar town and its surrounding woredas. Bahir dar town is located along Lake Tana and river Abay at a distance about 565 km from Addis Ababa. The altitude of the area is 1830 m.a.s.l. with the average annual rain fall of 1500mm and the lower and higher Temperature is 10°C and 30°C, respectively. The major farming system of the area is mixed crop –livestock system [9].

**Study Animals:** Animals which were coming to Bahir dar municipal abattoir for slaughter were the study population. Animals were originated from Bahir dar, Adet, Debre tabor and Este areas. The origin of animals was obtained from merchants that supply animals to the abattoir.

**Study Type and Sampling Method:** A cross-sectional study was carried out from November 2010 to March 2011. The total number of cattle required for the study was calculated based on the formula given by Thrusfield [10] for a simple random sampling method. By rule of thumb where there is no information for an area it is possible to take 50% of expected prevalence. Using 5% degree of absolute precision, 384 animals need to be sampled but, to increase the precision of prevalence estimates we sampled 465 animals.

### Study Methodology

**Post-Mortem Inspection:** Ante mortem inspection was carried out on different organs including: lung, liver, spleen, kidney, heart, masseter muscle, tongue, for both of bovine cysticercosis and hydatid cyst. For *Cysticercus bovis*, each predilection sites were inspected according to the guide line by Ministry of Agriculture [11]. Randomly selected positive samples from each organ were transported to the parasitology department of Bahir dar Regional Veterinary laboratory for confirmation of cyst viability. The cysts were incubated at 37°C for 1-2 hrs using 40% ox bile solution diluted in saline solution. Then, the scolex was examined under microscope by pressing between two glass slides. The cysts were

regarded as viable if the scolex evaginat. Individual cysts were grossly examined for any evidence of degeneration and calcification.

For the case of hydatid cysts, individual cysts were carefully incised and examined for protoscolices. Randomly selected Hydatid cyst was examined for fertility. Then, fertile cysts were subjected to viability test. A drop of the sediment containing the protoscolices were placed on the microscope glass slide and cover 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 on microscope slide with the principle that viable protoscolices should completely or partially exclude the dye while the dead ones take it up [12].

**Data Management and Analysis:** The outcome variables of the study were cases of *Cysticercus bovis* and *hydatid cyst* detected during routine post-mortem inspection. Univariate logistic regression and Chi-square tests were employed using STATA statistical software (version 11) to see the influence of the different presumed risk factors on the outcome variables. In all the analysis, confidence level was held at 95% and  $p < 0.05$  was set for significance of differences.

## RESULT

**Prevalence and Associated Risk Factors:** Of 465 heads of cattle slaughtered and examined at the abattoir, 12 (2.58%) and 148 (31.8 %) cattle were positive for bovine cysticercosis and hydatid cyst, respectively. Cattle from extensive production system and those from Adet had higher infection rate with eggs of *E. granulosus* and *T. saginata* than cattle from intensive production and other origins (Table 1 and 2).

**Cystercus Bovis:** Association between the prevalence of bovine cysticercosis and the three risk factors considered is presented in Table 1. Accordingly, no statistically significance difference ( $p > 0.05$ ) was observed in the prevalence of bovine cysticercosis among cattle from different origins and between the management systems. In contrast, there was a statistically significance difference ( $\chi^2 = 15.47$ ,  $p < 0.001$ ) in the prevalence of bovine cysticercosis between castrated and non castrated animals. Thus, bovine cysticercosis was more likely to occur in uncastrated cattle (OR=8.06, 95% CI=2.37–27.38) when compared to castrated cattle.

Table 1: Logistic regression analysis of risk factors associated with the occurrence of Bovine cysticercosis

| Risk factor |               | Total inspected | No (%) of positives | OR (95% CI)      | P-value |
|-------------|---------------|-----------------|---------------------|------------------|---------|
| Origin      | Bahirdar      | 176             | 1 (0.5%)            | 1                | -       |
|             | Adet          | 106             | 5(4.7%)             | 8.66(0.99,75.19) | 0.05    |
|             | Debre tabor   | 95              | 2(2.1%)             | 3.76(0.33,42.05) | 0.28    |
|             | Este          | 88              | 4(4.5%)             | 8.33(0.91,75.71) | 0.06    |
| Management  | Intensive     | 221             | 3(1.36%)            | 1                | -       |
|             | Extensive     | 244             | 9(3.67%)            | 2.75(0.73,10.32) | 0.13    |
| Castration  | Castrated     | 367             | 4(1.08)             | 1                | -       |
|             | Non castrated | 98              | 8(8.16%)            | 8.06(2.37,27.38) | 0.001   |

Table 2: Logistic regression analysis of risk factors associated with the occurrence of hydatid cyst

| Risk factor |               | Total inspected | No (%) of positives | OR (95% CI)      | P-value |
|-------------|---------------|-----------------|---------------------|------------------|---------|
| Origin      | Bahirdar      | 176             | 33 (18.7%)          | 1                |         |
|             | Adet          | 106             | 47(44.3%)           | 3.45(2.01,5.91)  | 0.000   |
|             | Debre tabor   | 95              | 32(33.7%)           | 2.20(1.24,3.88)  | 0.007   |
|             | Este          | 88              | 36(40.9%)           | 3.00(1.69,5.29)  | 0.000   |
| Management  | Intensive     | 221             | 49(22.7%)           | 1                |         |
|             | Extensive     | 244             | 99(40.4%)           | 2.37(1.57,3.56)  | 0.000   |
| Castration  | Castrated     | 367             | 80(21.8%)           | 1                |         |
|             | Non castrated | 98              | 68(69.1%)           | 8.13(4.95,13.35) | 0.000   |

Table 3: Distribution of *C. bovis* and hydatid cyst in the organs inspected

| Organs inspected | Cysticercus bovis |                | Hydatid cyst |                |
|------------------|-------------------|----------------|--------------|----------------|
|                  | No positive       | Proportion (%) | No positive  | Proportion (%) |
| Tongue           | 10                | 2.2%           | 0            | -              |
| Masseter muscle  | 9                 | 1.9%           | 0            | -              |
| Heart            | 6                 | 1.3%           | 0            | -              |
| Liver            | 1                 | 0.2%           | 59           | 12.7%          |
| Lung             | 0                 | -              | 98           | 21%            |
| Kidney           | 0                 | -              | 20           | 4.3%           |

Table 4: Viability of *C. bovis* in organs inspected during the study period

| Cysticercus bovis |               |             |
|-------------------|---------------|-------------|
| Organs inspected  | Cyst examined | Viable cyst |
| Tongue            | 27            | 9 (33.3%)   |
| Masseter muscle   | 15            | 6 (40%)     |
| Heart             | 11            | 3 (27.3%)   |
| Liver             | 3             | 1 (33.3%)   |
| Total             | 56            | 19 (33.9%)  |

Table 5: Fertility and viability of Hydatid cyst in organs inspected during the study period

| Hydatid cyst    |                |                |           |                |           |
|-----------------|----------------|----------------|-----------|----------------|-----------|
| Organ inspected | Cysts examined | Fertility test |           | Viability test |           |
|                 |                | Fertile        | Sterile   | Viable         | Dead      |
| Lung            | 122            | 63 (51.6%)     | 37(30.3%) | 35(28.7%)      | 28(22.9%) |
| Liver           | 75             | 26(34.7%)      | 38(50.7%) | 8(10.67%)      | 18(24%)   |
| Kidney          | 28             | 0              | 4(14.3%)  | 0              | 0         |
| Total           | 215            | 89(41.4%)      | 79(36.7%) | 43(20%)        | 46(21.4%) |

**Hydatid Cyst:** Prevalence of hydatid cyst showed significant variation between cattle of different origins ( $\chi^2=25.05$ ,  $p<0.001$ ) and management ( $\chi^2=16.7$ ,  $p<0.001$ ). Hydatidosis was more likely to occur in animals from Adet (OR=3.45, 95% CI=2.01-5.91) Este (OR=3.00, 95% CI=1.69-5.29) and Debre tabor (OR=2.20, 95% CI=1.24-3.88), extensive (OR=2.3, 95% CI=1.57-3.56) of cattle when compared to animals originated from Bahir dar (18.7%) and cattle from intensive management (22.7%) (Table 2).

**Anatomical Distribution, Viability and Fertility of the Cyst:** Of the organs examined, the highest proportion of *C. bovis* were observed in the tongue (2.2%) followed by Masseter muscle (1.9%), heart (1.3%) and liver (0.2%). Table 3 shows that highest proportion of Hydatid cyst was recorded in lung (21%) followed by liver (12.7%) and kidney (4.3%).

**Viability of Cysticercus Bovis:** Two to three randomly selected cysts (*C. bovis*) taken from each organ were examined for rough calculation of cyst viability test for the respective organs inspected. Of the total 56 *C. bovis* cysts randomly collected from different organs for viability test, 19(33.9%) were found to be alive while the remaining 37 (66.1%) were degenerated cysts. Relatively, most cysts collected from masseter muscle were viable than from tongue and heart. There was no statistically significant variation ( $p=0.93$ ) in the viability of cysts collected from the different organs examined (Table 4).

**Fertility and Viability of Hydatid Cyst:** Two hundred fifteen hydatid cysts randomly taken from all positive organs were subjected to laboratory tests and 89(41.4%) were fertile, 79 (36.7%) were sterile and 47(21.86%) were calcified. Moreover, viability test indicated that 43(20%) of cysts were found to be viable. Cysts from lungs were relatively fertile (51.6%) and viable (28.7%) than cysts of the liver and kidney (Table 5).

## DISCUSSION

During the study period, the occurrence of Bovine cysticercosis in cattle at Bahir Dar municipal abattoir was found to be 2.58%. The current study agreed with the findings of Tembo [13], Taresa *et al.* [14] and Ibrahim and Zerihun [15] who reported 3.2%, 3.65% and 3.6% prevalence at central part of Ethiopia, Jimma and Addis Ababa localized abattoirs, respectively. However, the current finding showed marked variation when compared

with the findings of Abunna *et al.* [16], Ahmed *et al.* [17] and Kebede *et al.* [18], who reported prevalence of 26.25%, 21.17% and 7.5% from Hawassa, Nekemit and Addis Ababa abattoirs, respectively. The observed different among these studies could be explained with the agro-climatic conditions of the study areas, the number of incision made during inspection, the ability of the meat inspector to identify the cases, habit or culture of raw meat consumption, sample size and sampling method, level of environmental contamination with the eggs of *T. saginata*, dose and viability of egg consumed [4]. From personal observation, areas known for high trend of eating raw meat and backyard slaughter, like the case in Hawassa and Nekemit, are more exposed for *C. bovis* and hence more cases of Bovine cysticercosis in cattle.

Bovine cysticercosis was not statistically variable among the different origins of the slaughtered animals. Similar result was reported previously by Regassa *et al.* [19] in Wolaita Soddo municipality abattoir. This finding can partly be explained by a more or less similar habit of raw meat consumption of these geographically and socio-economically related areas. Although higher numbers of cattle brought from extensive management system were infected, the prevalence of bovine cysticercosis infection between the two management systems also showed no significant difference. This could be related to the small number of positive cases encountered, which is not sufficient to bring marked difference during the analysis. However, cattle came from intensive management system had less exposure to the infection because they are kept in good feeding and housing management. Moreover, preventive measures like restricted access to contaminated areas, zero grazing and environmental sanitation are more practiced in intensive management system. The difference in the prevalence of *C. bovis* between castrated and uncastrated cattle was statistically significance ( $P<0.001$ ), the higher prevalence being recorded in uncastrated cattle (OR=8.066, 95% CI=2.37 – 27.38). This could be associated with the origin of these animals i.e. almost all castrated animals were from intensive management system which in turn reduce the exposure of grazing a contaminated field by human feces. Moreover, castrated animals have a tendency to be docile and not interested to move here and there for searching cows. This behavioral change might have influence on their feeding habit, which in turn reduce the exposure of grazing a contaminated field.

The presence and the number of cysts in any given site varied greatly among animals and demonstrate the absence of any true predilection site for *C. bovis* [4].

In the current study, like other previous studies [19-22], the tongue, masseter muscle, heart and liver were the predilection site for the cysts of the *C. bovis*. In addition to the above organs, shoulder muscles and diaphragm are also the common predilection site for the cysts of *C. bovis*. In this study, examination of the shoulder muscle and the diaphragm couldn't be done because the inspector, slaughter house personnel and the owner or his/her representative were not voluntary to let inside and inspect those muscle.

The prevalence of hydatidosis in cattle recorded in this study (31.8%) agreed with the findings of Getachew [23] 31.44% in Jimma. However, it showed slight variation with the finding of Tigist [23] 36.58 % in the same study area. In contrast, the present study disagree with the report of Kebede *et al.* [25] 16% in Wolita sodo, Alemayehu [26] 54.8% in Assela and Kebede *et al.* [22] 48.9% in Debre Markos and Wubet [27] 62.96% in Bale Robe. The variation in prevalence of hydatidosis from different areas of a country might be attributed mainly to the strain difference of *Echinococcus granulosus* that exist in different geographical location [28]. On top of that, differences in animal husbandry system, backyard slaughtering of animals, lack of proper disposal of infected carcass and presence of stray dog could attribute for the variation in prevalence of hydatidosis [29]. Furthermore difference in culture, social activities and attitudes to dogs in different region may contribute for variation [12].

Regarding organ distribution, the current study showed that lungs (21%) were the most preferred predilection site for hydatid cysts followed by liver (12.7%). This might be due to the fact that cattle are slaughtered at older age, during which period the liver capillaries are dilated and most oncospheres pass directly to the lung. It is also possible for the hexacanth embryo to enter the lymphatic circulation and be carried via the thoracic duct to the heart and then trapped in the lungs [30]. Furthermore, the lungs and liver possess the first great capillaries 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 [31].

The result of fertility test (44.4%) conducted on randomly selected hydatid cysts was relatively higher than other reports made so far; in Wolayita Sodo 1.76% [25] and in Debre Markos 10.1% [22]. The variation in fertility rate among these studies, in different species and in different geographical zone could be due to the differences in strain of *E. granulosus* [28]. Though not

proven, the fertility rate of hydatid cysts may show a tendency to increase with advancing age of the host. The fertility rate among different organs also showed varied proportion. Accordingly, cysts in the lungs took the higher proportion of fertility rate. It has been stated that the relatively softer consistency of the lung tissue allows the easier development of the cyst and this may be aggravated 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 the hydatid cysts [22].

Unlike the case in lungs, relatively higher number of calcified cyst encountered in the liver (24%). The liver is firm in consistency and lack suitable matrix for long term cyst survival and hence the cyst degenerate earlier than the once found in lungs. The higher number of calcified cysts in the liver could also be attributed to relatively higher reticuloendothelial cells and abundant connective tissue reaction of the organ [19].

## CONCLUSION

The recorded prevalence of cysticercosis was found to be lower as compared to previous findings from different part of the country. In the study area, the introduction of urban and rural health extension programs that taught the people intensively to use latrine might have a significant role for reduced prevalence of *cysticercus bovis*. However, the present study and some other past studies showed higher prevalence of hydatid cyst. Backyard slaughtering with a tendency to give condemned visceral organs to dogs and keeping unhygienic dogs in close association with animals and humans are the major factors which favor the life cycle to continue and hence a higher infection rate in cattle. Thus, awareness should be created in the public particularly on the risk of backyard slaughtering of food animals and offering infected offals to dogs.

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