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# Prevalence and Economic Importance of Hydatidosis in Cattle Slaughtered at North Gonder Elfora Abattoir

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**Abstract:** A cross-sectional study was conducted from October 2011 to April 2012 to assess the status of cystic hydatidosis in cattle slaughtered at Gondar Elfora abattoir. Out of the total 400 cattle examined visually and manually (palpation and incision), 112 (28%) were found harboring hydatid cysts. A significantly higher infection was detected in older cattle ($P<0.05$, $P2=12.191$) than young. Regarding body condition score, no significant variation ($P>0.05$, $P2=2.148$) was observed as the prevalence was 36.6% for medium cattle followed by lean (31.7%) and fat (17.6 %). Of the total 112 infected, 45 (40.2%) had hydatid cysts only in the lung, 28 (25%) in the liver while the rest 39 (34.8%) had multiple organ infections. Of the 154 viscera harboring hydatid cysts, the highest (54.5%) was lung followed by liver (43.5%), spleen (1.3%) and heart (0.65%). In addition, out of the total 154 cysts collected, 26 (16.9%) were fertile, 86 (55.8%) sterile and 42 (27.3%) calcified or purulent cysts. There was a significant difference in fertility of cyst from different organs ($P<0.05$, $P2=27.96$), those of lung origin being highly fertile. Likewise, out of the 26 fertile cysts subjected for viability test, 8 (30.77) were viable. Considering the current result, the total annual economic loss from organ condemnation and carcass weight loss due to bovine hydatidosis at Gondar Elfora abattoir was estimated at 674,093.038 ETB (1USD= 17.8349 ETB).

**Key words:** Abattoir % Bovine % Prevalence % Economic Significance % Gondar % Hydatidosis

## INTRODUCTION

Cystic Echinococcosis (hydatidosis) is a zoonotic parasitic infection of many mammalian species caused by the larval stage of *Echinococcus granulosus* [1]. The definitive host of the parasite, *E. granulosus*, is dogs which harbor the adult parasite and excrete the parasite eggs along with their feces, while livestock and human are the intermediate hosts [2]. Hydatid disease 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 [3].

Hydatidosis is one of the important parasitic diseases of livestock that has both economic and public health significance. It is associated with severe morbidity and disability and is one of the world's most geographically widespread zoonotic diseases. The pathogenesis 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. Previous studies have shown that cystic echinococcosis represented a considerable economic and public health significance in different countries [4].

The disease occurs throughout the world and causes considerable economic losses and public health problems in many countries. Hydatidosis causes decreased livestock production and condemnation of offal containing hydatid cysts in slaughter houses. Despite the large efforts that have been put into the research and control of echinococcosis, it still remains a disease of worldwide significance. In some areas of the world, Cystic echinococcosis caused by *E. granulosus* is a re-emerging disease in places where it was previously at low levels [5].

The life cycle of these parasites involves two mammalian hosts. The adult cestode inhabits the small intestine of carnivores (definitive host) and produces eggs containing infective oncospheres. Either cestode

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segments, proglottids containing eggs or free eggs are released from the intestinal tract of the carnivores into the environment. After ingestion of eggs by an intermediate hosts (food animals: cattle, sheep, goats, pigs and camel) the larval stage a metacestode, develops in internal organs [6].

The epidemiology of hydatidosis various from one area to another so control measures appropriate in one area is not necessarily of value in another [7]. Hence, it is essential to have adequate knowledge of the epidemiology of the disease before contemplating control programs [4]. Therefore the objectives of this paper are to determine the prevalence of bovine hydatidosis in Gondar and to asses the economic importance of bovine hydatidosis due to organ condemnation and carcass weight loss.

## MATERIALS AND METHODS

**Study Area:** The study was conducted in Gondar Elfora abattoir, North Gondar zone, Amhara National Regional State (ANRS).

The Gondar town is located at 742 Km from Addis Ababa at an elevation of 2133 m.a.s.l. The city has a latitude and longitude of \12°36'N 37°28'E / 12.6°N 37.467°E. Rain fall varies from 880-1172mm with the average annual temperature of 19.7°C. The area is characterized by two seasons, the wet season from June to September and dry season from October to May. The farming system in the area is mixed type (crop-livestock production). The cattle population of the area is 2,407,544 [8].

**Study Animals:** The study animals were indigenous zebu cattle brought from various localities to Gondar Elfora abattoir for slaughtering purposes. It was difficult to precisely indicate the geographical origin of all animals slaughtered at Gondar Elfora abattoir and relate the findings on hydatidosis to a particular locality. Nevertheless, attempts made in this regard revealed that majority of them were brought from nearby markets.

**Sample Size:** The sample size was determined by simple random sampling method using 95% confidence interval at a desired absolute precession of 5% according to the formula given by Thursfield [9]. Therefore, the required sample size was 384. However to increase the level of accuracy of determining the prevalence the sample size has been increased to 400.

**Study Design:** A cross-sectional study was conducted to determine up to date information on the prevalence, economic impact and cyst characteristics of bovine hydatidosis at Gondar Elfora abattoir. Systematic (three slaughtering days per week) visits were made to Gondar Elfora abattoir from December 2008 to March 2009. All cattle presented on each visit day were examined.

**Study Methodology**

**Antemortem Examination:** During antemortem inspection, each of the study animals was given an identification number (with a paint mark on their body). Age, sex and body condition scoring of the study animals were also recorded. Estimation of age was carried out by examination of the teeth eruption using the approach forwarded by De Lahunta and Habel [10]. Two age groups were considered; less or equal to 5 years and above 5 years old. Since almost all the cattle presented to slaughtering in the study area were male, infection rate regarding sex variation was not included. The body condition scoring was classified into three categories as lean medium and fat according to Nicholson and Butterworth [11].

**Postmortem Examination:** Postmortem examination was carried out through visual inspection, palpation and incision of visceral organs (lung, liver, heart, spleen and kidney) and the presence of hydatid cyst and the organ distribution were recorded. Hydatid cysts were carefully removed and separately collected (in organ basis) in clean containers for further cyst characterization. Hydatid cyst characterization was made to assess the status of the cysts.

**Cyst Characterization**

**Cyst Fertility and Viability:** The pressure of the cyst fluid was reduced by using a sterile hypodermic needle. Then cyst was incised with a sterile scalpel blade and the content was poured into a glass Petri dish and examined. The presence of protoscolices either attached to the germinal layer in the form of brood capsule or its presence in the cyst fluid was considered as indicative of fertility [12]. Fertile cysts were further subjected to viability test. A drop of fluid from cyst containing the protoscolices were placed on the microscope glass slide and covered with cover slip and observed for amoeboid like peristaltic movements with ×40 objective. For clear vision, a drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices in hydatid fluid on microscope slide with

the principle that viable protoscolices should completely or partially exclude the dye while the dead ones take it up [12, 13]. Sterile hydatid cysts are characterized by their smooth inner lining, usually with a slight turbidity of the contained fluid and typical calcified cyst that produced a gritty sound feeling upon incision [14, 15].

**Economic Loss Evaluation:** Financial losses due to hydatidosis means due to condemnation of liver, lung, heart and other organs and cost due to carcass weight reduction (indirect loss) were carried out.

Annual economic loss due to organ condemnation was determined by considering annual slaughter rate of cattle and prevalence of hydatidosis per organ and an estimated 5 % carcass weight loss [16] was considered. Average carcass weight of Ethiopian local breed cattle is estimated as 108 kg [17].

**Data Analysis:** Data obtained from antemortem and postmortem findings in the abattoir and further characterization of cysts in the laboratory was coded and uploaded into Microsoft Excel 2003 spreadsheet computer program. Then it was analyzed by using SPSS version 16.0 for windows software and Chi-square ($P^2$) test was applied to compare the infection status with regard to the hypothesized risk factors like age, body condition scores and cyst characteristics.

## RESULTS

### Prevalence

**Overall Prevalence:** Out of the total 400 heads of cattle slaughtered and examined, 112 (28%) were infected with hydatid cyst, harboring one or more cysts involving different visceral organs (lung, liver, heart, spleen and kidney).

**Prevalence of Hydatid Cyst on the Basis of Age:** Rate of infection in different age groups (#5 and >5 years) was assessed and described (Table 1). Age prevalence has shown a statistically significant variation ($P<0.05$, $P^2=12.191$) with older group having higher infections.

**Prevalence of Hydatid Cyst on the Basis of Body Condition:** Prevalence was also assessed in terms of body condition score (Table 2). It was found that cattle having poor body condition had the highest prevalence (32.5%) followed by medium (28.4 %) and fat (24.6 %). The difference in prevalence rate among the body condition scores was statistically insignificant (p= 0.446, $P^2=1.617$).

Table 1: Prevalence of hydatidosis in different age groups

| Age group (yrs) | No. of cattle examined | Infected | Prevalence | $P^2$ | P |
|---|---|---|---|---|---|
| Group 1 (#5 year) | 57 | 5 | 8.8% | 12.191 | .000 |
| Group 2 (>5 year) | 343 | 107 | 31.2% | 12.191 | .000 |
| Total | 400 | 112 | 28.0% | | |

Table 2: Prevalence of hydatidosis in cattle slaughtered on body condition basis

| | | Infected | |
|---|---|---|---|
| Body condition score | Animals Examined | Number | Percent (%) |
| Lean | 83 | 27 | 32.5 |
| Medium | 183 | 52 | 28.4 |
| Fat | 134 | 33 | 24.6 |
| Total | 400 | 112 | 28.0 |

P-value= 0.446, $P^2=1.617$

**Distribution of Hydatid Cyst in Different Organs:** Overall distribution of cysts in different organs of cattle slaughtered at Gondar Elfora abattoir was described (Table 3). Of the total 112 cattle positive, 45 (40.178%) had cysts merely in lungs, 28 (25%) in liver, whereas, the rest of 39 (34.82%) infections involved multiple organs.

**Cyst Characterization:** A total of 84 cysts of lung, 67 cysts of liver, 2 cysts of spleen, 1 cysts of heart origins were taken and subjected to cyst characterization (Table 4).

**Cyst Fertility:** Out of 154 cysts tested for fertility, observation indicated that 21 (25.00%) cysts of lung and 5 (7.50 %) cysts of liver origins had protoscolices detected and hence, fertile. The rest were either sterile or calcified (Table 5).

**Cyst Viability:** A total of 26 fertile cysts originating from lung and liver were tested for viability. The examination indicated that 7 cysts from lung and 1 cyst from liver origin had viable protoscolices showing the amoeboid like peristaltic movement (flame cell motility) and up on staining with 0.1% aqueous eosin solution, the viable protoscolices partially/totally excluded the dye while the dead ones take it up (Table 6).

**Estimation of Economic Loss:** Loss due to organ condemnation was estimated at 41011.0781 ETB annually and due to carcass weight loss was 633081.96 ETB. The total annual loss encountered due to hydatidosis in cattle slaughtered at Gondar Elfora abattoir is estimated at 674,093.038 ETB.

Table 3: Distribution of hydatid cysts in different organs of positive cattle

| | Number of animal | | | |
|---|---|---|---|---|
| Organs infected | Examined | No. of cases | % | Proportion from infected (%) |
| Lung only | 400 | 45 | 11.25 | 40.178 |
| Liver only | 400 | 28 | 7.00 | 25.000 |
| Heart only | 400 | 0 | 0.00 | 0.000 |
| Spleen only | 400 | 0 | 0.00 | 0.000 |
| Lung and liver | 400 | 36 | 9.00 | 32.142 |
| Lung and heart | 400 | 1 | 0.25 | 0.892 |
| Lung, liver and spleen | 400 | 2 | 0.50 | 1.785 |
| Total | 400 | 112 | 28.00 | 100.000 |

Table 4: Distribution of hydatid cysts in different organs and proportion of organs involved in the study animals

| Proportion (%) | | | | |
|---|---|---|---|---|
| Organ | Examined | Affected | From infected animal | From total examined animal |
| Lung | 400 | 84 | 75 | 21.0 |
| Liver | 400 | 67 | 59.8 | 16.8 |
| Spleen | 400 | 2 | 1.785 | 0.5 |
| Heart | 400 | 1 | .89 | 0.2 |
| Total | 400 | 154 | 38.5 | 28.0 |

Table 5: Fertility/sterility of cysts collected from different organs of Cattle slaughtered at Gondar Elfora abattoir

| Organ | Fertile cyst (%) | Sterile cyst (%) | Calcified (%) |
|---|---|---|---|
| Liver | 5(7.5) | 27(40.3) | 35(52.2) |
| Lung | 21(25) | 56(66.7) | 7(8.3) |
| Spleen | 0(0.00) | 2(100.00) | 0(0.00) |
| Heart | 0(0.00) | 1(100.00) | 0(0.00) |
| Total | 26(16.88) | 86(55.84) | 42((27.27) |

Table 6: Viability statuses of fertile cysts collected from organs of Cattle slaughtered at Gondar elfora abattoir.

| Organ involved | Viable cyst (%) | Nonviable cysts (%) | Total |
|---|---|---|---|
| Lung | 7(33.33) | 14(66.67) | 21 |
| Liver | 1(20.00) | 4(80.00) | 5 |
| Total | 8(30.77) | 18(69.23) | 26 |

## DISCUSSION

The current study revealed a prevalence of 28% was in agreement with previous work of Yetnayet [18] who reported a prevalence of 27.2% in the Gondar town and Zewdu *et al.* [5] who reported a prevalence of 29.69% in Ambo area and higher than observations made by Azlaf and Dakkak (19) in Morocco (22.9%) and very lower prevalence were also reported by Kebede *et al.* [20] in Shire (7.5%) and by Tsehaye (21) in Debre Birhan (7.2%).

Higher prevalence was registered in other areas of which 72.44% in Asella [22], 59.9% in Bahir Dar [23], 62.96% around Bale Robe [24], 52.69% around Hawassa [1].

However, the extent to which results were documented from different locations tends to show variable scales. The variation in prevalence from different areas of a country might be attributed mainly to the difference in strains of *E. granulosus* that exist in different geographical situations (25) and other factors like difference in culture, social activity and attitude to dog in different regions [12].

In this study, a significant variation was observed in the rates of infections between age groups where animals above 5 years of age were highly infected. This is in agreement with the findings of Azlaff and Dakkak [20] and Regassa *et al*. [1]. This could be mainly due to the fact that aged animals have longer exposure time to eggs of *E. granulosus* in addition to weaker immunity to combat against the infection [26]. In addition most of the slaughtered animals were culled animals due to less productiveness and hence were exposed to the diseases (parasitic ova) over long period with an increased possibility of acquiring the infections.

The prevalence of hydatidosis was slightly higher in cattle having poor (lean) (32.53%) followed by medium body condition (28.41%) and fat (24.62%). Polydrous [27] explained that in moderate to severe infections, the parasite may cause retarded performance and growth, reduced quality of meat and milk, as well as live weight loss.

The result on organ prevalence study showed that lungs were found to be the most commonly affected organs followed by liver with prevalence of 75% and 59.8%, respectively. Similar findings were reported by Fekadu [22], Getachew [28], Yemane [29], Nebiyou [23], Yilkal [30], Abebe [31], Haftay [32], Yechale [33] and Zelalem [34]. But this result contradicts with Soulsby [15] and Fikre [35]. 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 directly pass to the lung; additionally, it is possible for the hexacanth embryo to enter the lymphatic circulation and be carried via the thoracic duct to the heart and lungs in such a way that the lungs may be infected before or instead of liver [36].

The overall percentage of fertile cysts in this study was 16.9 %. This finding was comparable to the fertility rate of 19.3% of Zelalem [34]. But this finding is quite lower compared to the finding of 70% in Great Britain, 96.9% in South Africa and 95% in Belgium [36]. Yet much lower fertility rates of 1.76% around Wolayita Soddo [37], 9.85% in Nekemt [38], 6.2% in Bahir Dar (23) were reported. The variation in fertility rates among different species and in different geographical zone could be due to difference in strain of *echinococcus granulosus* [39]. In comparison of the fertility rate of different organs it was higher for lung than liver while other organs are almost sterile. The fertility rate of lung (25%) is higher than that of liver (7.5%). This may be due to the softer consistency of the lung tissue allows the easier development of the cyst and the fertility rate of hydatid cyst may show a tendency to increase with advancing age of the hosts [26]. This may be attributed probable due to reduced immunological compatibility of animals at their old age of infection. The variation between tissue resistances of the affected organs may also influence the fertility rate of cysts, in the liver hosts reaction may limit fertility rate of hydatid cysts. The variation in fertility, sterility and calcification in different areas were described as strain difference [36].

Greater number of viable protoscolices (33.33 %) in lung followed by liver (20 %) was found. The overall prevalence of viable protoscolices was 30.77 % and this indicates cattle are an important intermediate host for the perpetuation of the life cycle of the parasite.

In the present study, the annual economic loss due to bovine hydatidosis at Gondar elfora abattoir from direct and indirect losses was estimated to be about 674,093.038 ETB was lower than from previous report by Regassa *et al*. [1 ] 1,791,625.89 Ethiopian Birr loss and higher than to estimate of 25,608 Ethiopian Birr loss in Tigray region [20]. The difference in economic loss analysis in various abattoirs\regions may be due to the variations in the prevalence of the disease, mean annual number of cattle slaughtered in different abattoirs and variations in the retail market price of organs [27].

## CONCLUSION

The overall prevalence observed in the study indicated relatively high and an important zoonotic disease in the area and this could be due to several factors of which keeping dogs in close association with cattle. Hydatidosis also causes substantial visible and invisible economic losses in cattle of the study area as a result of condemnation of edible offal and carcass weight loss. The most preferred predilection sites of hydatid cyst in cattle like liver, kidney, heart and lungs and condemnations of these important organs having a single or multiple hydatid foci is really a huge loss.

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