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# Prevalence and Viability of Hydatidosis in Cattle Slaughtered at Sebeta Municipal Abattoir, Central Ethiopia

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**Abstract:** The aim of this study was to estimate the prevalence of hydatid cysts in slaughtered cattle at Sebeta Municipal abattoir and assess associate risk factors. In this cross sectional study from November 2011 to March 2012, a total of 395 animals were inspected using post morteum examination. Out of animals examined, 97 (24.5%) cattle were harbored hydatid cysts. Prevalence of hydatidosis significantly different among animals origins ($p$=0.01), where animals originated near to Addis Ababa had high prevalence as compared to region far away from Addis Ababa. Age group above 10 years and poor body condition showed significantly high prevalence ($p$<0.05) than age group less than 10 years and good body condition scores. The study has shown that 16% fertile-viable cysts and the remaining were infertile. Hydatidosis was more prevalent near Addis Ababa (29.2%), where there is better living standard difference and the opportunity of frequent slaughtering at backyard in one or other reasons and poor managements of infected organs in the area might have contributed for the prevalence. Among organs examined, the highest proportion of fertile-viable cyst were observed in the heart 4 (40%) followed by lung 15 (17%), kidney 3(11.1%) and liver 2 (10.2%). The highest proportion of the non-fertile or sterile cyst observed in the lung and kidney. Calcified hydatid cyst was higher in spleen followed by liver, kidney and lung. The current results suggest that a region based thorough investigation is paramount important to facilitate disease control strategy in the country, which helps to reduce the economic loss and public health consequences of the hydatidosis.

**Key words:** Hydatidosis · Prevalence · Viability · Cattle · Sebeta Municipal Abattoir · Ethiopia

## INTRODUCTION

Hydatidosis is a zoonotic parasite disease caused by larval stage of cestodes belonging to the genus *Echinococcus* and the family *Taeniidae*. The parasite perpetuates itself using two hosts. In the lifecycles carnivores are definitive hosts, which harbor the adult parasite and discharge gravid proglotid with its egg on the environment. The intermediate host ingests feed contaminated with eggs and it develops into infective metacestodes stage after oral ingestion of the eggs [1].

The most common site for the larval cysts is liver and lungs as observed by different researchers. The pathogencity of hydatidosis heavily depends on the extent and severity of infection and the organ on which it is situated. The most common symptoms are associated with compression of nearby organs or blood vessels and increased size of the cyst. Occasional rupture of hydatid cysts often leads to sudden death due to anaphylaxis, haemorrhage and metastasis [2, 3].

The larva may incubate for months or even years. Cystic echinococcosis(CE) affects livestock and human being and has both economic and public health significance [4-6].

It is associated with severe morbidity and disability and is one of the world's most geographically widespread zoonotic diseases. Diagnosis of echinococcosis in final host depends on the demonstration of adult cestodes in their faeces or small intestine. In intermediate hosts, diagnosis depends on detection of the larval cysts that can infect almost any organ, mainly liver and lungs [7].

The disease has greater public health importance and economic impact in countries where livestock industry is an important segment of the agricultural sector and when livestock production is based on mainly extensive grazing system. In addition, backyard slaughter of animals, the corresponding absence of rigorous meat inspection procedures, the longstanding habit of feeding domesticated dogs and wild carnivores with condemned offal and the subsequent contamination of pasture and

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grazing fields contributes more than expected. This can facilitate the maintenance of the life cycle of *Echinococcus granulosus* (*E. granulosus*), which are the causative agent of cystic hydatidosis and consequently the high rate of infection of susceptible hosts [8].

Therefore, the objectives of this study were designed to the prevalence of hydatidosis in cattle slaughtered in Sebeta municipal abattoir and to associate epidemiological factors.

## MATERIALS AND METHODS

**Study Area:** The study was conducted at Sebeta municipal abattoir from November 2011 to March 2012. Sebeta town is located in Oromia regional state near to Addis Ababa, Ethiopia; approximately 25 kms Southwest of Addis Ababa with an altitude of 2780m.a.s.l. The minimum and maximum mean temperature ranges from11.3$^0$c to 28$^0$c with relative humidity of 49.3%. However, the climate of the study area represent that of the highland of Ethiopia; animals were brought from different agroclimatic area hence it would be better to consider the climate as highland, midland and lowland climatic condition in the country.

**Study Animals:** The study animals were cattle, which came from different zones. Sample size was determined based on the formula given by [9] using systemic random sampling method. Expected prevalence of 50% was considered, as there was no previous information in the abattoir. Using 95% confidence interval and with desired precision levels of 0.05. However, few numbers were added during study period, which does not bring significant effect on time as well as cost wise. Therefore, a total number of 395 samples were inspected during study period.

**Active Abattoir Survey:** Study animals were selected from Sebeta municipal abattoir every three days of the week; at ante mortem inspection data were collected about related risk factors such as age, sex, breed, body condition and origin of the individual animals was assessed and recorded. Body condition score were ranked as poor, medium and good. Animal origin was also recorded near the vicinity of Addis Ababa (50kms round), 100kms distance radius and above 100kms distance radius. During the postmorteum examination, a thorough visual inspection, palpation and systemic incision of each visceral organ particularly the liver, lung, kidney, heart and spleen was carried out according to procedures recommended by [10]. All cysts were transported to National animal health diagnostic and investigator centre (NAHDIC) for confirmation of cyst viability. Individual cysts were grossly examined for any evidence of degeneration and calcification and then the contents of cyst checked by transferring in to a sterile container and examined microscopically (40X) for the presence of protoscolices. Based on the presences or absence of protoscolices in hydatid fluid, cyst where identified and classified as fertile and non-fertile. The fertile cysts were also further studied for viability. Protoscolices viability was assessed by the motility of flam cells as well as staining with 0.1% aqueous solution of eosin. Viable protoscolices should completely or partially exclude the dye while the dead ones take it up [11].

**Data Management and Analysis:** Data was entered in Microsoft excel spread sheet, descriptive statistics were analyzed. Logistic regression was employed to analyze the association between hydatid cyst and potential risk factors (origin, breed, body condition, age and sex) using Stata 9 software [12]. Odds ratios were analyzed to see the degree of association between the risk factors and prevalence of the disease. The association considered as significant when the value of $p$ is less than 0.05.

## RESULTS

Out of 395 cattle post mortem examined 97 (24.55%) where found to be positive for hydatidosis. Table 1 and 2 shows the association between the prevalence of hydatidosis in cattle and risk factors. Accordingly, prevalence of hydatidosis showed significant difference between animals origin ($p$<0.05), where animals originated near to Addis Ababa had high prevalence as compared to animals came from far away from Addis Ababa. Area categorization was based on the distance from the site of slaughterhouse and accordingly, grouped into three areas as shown in Table 1. Age group above 10 years showed significantly high prevalence than other age groups ($p$<0.05). Significantly high hydatid cyst prevalence was also observed in poorly conditioned animals ($p$=0.00) than medium and good body conditioned animals. On the other hand, there was no difference between sexes of the animals. Thus, hydatidosis was more prevalent in animals near to Addis Ababa (29.2%) when compared to animals originated from Shewa (25.3%) and Jimma region (13%); The hydatidosis was more prevalent in old animals (42.5%) than young animals (20%).

Table 3 shows the proportion of hydatid cyst in organs inspected. A total of 142 organs were infected out of the total organ examined, either in single or more than

Table 1: Logistic regression analysis of risk factor based on origin of animals associated with the occurrence of hydatid cyst at Sebeta municipal abattoir during the study period

| Origin | No. sample | No. positive | Prevalence | OR and 95% CI | P. value |
|---|---|---|---|---|---|
| *Near to A.A | 137 | 40 | 29.2% | 1 | 1 |
| **Shewa | 189 | 48 | 25.3% | 1.21[0.74, 1.98] | 0.45 |
| ***West region | 69 | 9 | 13% | 2.7 [1.25, 6.09] | 0.01 |

* Animals originated near Addis Ababa (Alamgana, Adaberga, Butajira, Dima, Holota, Meta, sebeta, Sendafa and wolete) at a distance of 50kms radius.

** Animals originated from Shewa (Ambo, Awash, Ginchi, Jeldu, Gedo, Waliso, Taji, Tafki and Tulubolo) at a distance of 50kms up to 100 kms

*** Animals originated from West region (Bedelle, Gimbi, Illuababora, Jimma and Wellega) at a distance above 100kms

Table 2: Logistic regression analysis of risk factors associated with the prevalence of hydatid cyst in organ inspected at Sebeta municipal abattoir during the study period

| Risk factor | No. sample | No. positive | Prevalence [95% CI] | OR [95% CI] | P- value |
|---|---|---|---|---|---|
| Sex | | | | | |
| Female | 22 | 7 | 31.8[14.7,54.9] | 1 | 1 |
| Male | 373 | 90 | 24.1[19.9,28.8] | 1.47 [0.6, 3.7] | 0.42 |
| Age | | | | | |
| 3-5years | 35 | 7 | 20.0[9.1,37.5] | 1 | 1 |
| 6-10years | 320 | 73 | 22.8[18.4,27.9] | 1.18 [0.49, 2.8] | 0.71 |
| > 10years | 40 | 17 | 42.5[27.4,58.9] | 2.96 [1.04, 8.4] | 0.04 |
| BCS | | | | | |
| Poor | 26 | 16 | 61.5[40.7,79.1] | 1 | 1 |
| Medium | 276 | 75 | 27.2[22.1,32.9] | 4.3 [1.9, 9.9] | 0.01 |
| Good | 93 | 6 | 6.5[2.7,14.1] | 23.3 [7.4, 73.0] | 0.01 |

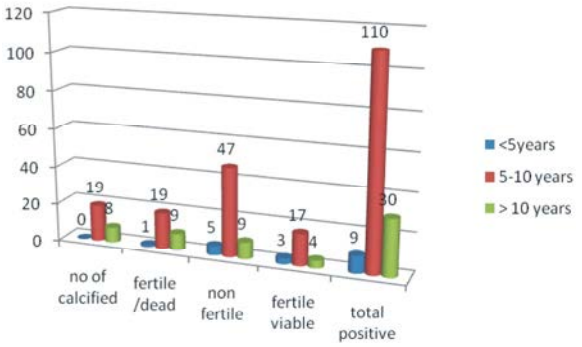


Fig. 1: Number and types of cysts recorded at different age category

Table 3: Proportion of organs infected with hydatid cyst

| Organ inspected | No. positive | Proportion |
|---|---|---|
| Lungs | 87 | (61.3%) |
| Liver | 19 | (13.3%) |
| Heart | 10 | (7%) |
| Kidney | 21 | (14.8%) |
| Spleen | 5 | (4%) |
| Total | 142 | 1 (100%) |

one organs involved in each animals. In this study, it was found that five visceral organs have been involved at various size of the cyst. Among these organs examined, the highest proportion of the hydatid cysts was recovered in the lungs (61.3%) followed by kidney (14.8%), liver (13.3%), hearts (7%) and spleen (4%).

Among the animals inspected, number of cysts in each age group was counted and it was shown that in age group less than 5 years, they had 7 positive cases with 9 cysts were found. Whereas, in age group between 5 to 10 years had 73 positive cases with a total of 110 cysts were found. On the other hand, in age group above 10 years there were 17 positive cases with 30 cysts were observed. Fig. 1 shows that there was more multiple infections found in older age group than young age group. In general the finding indicates that 24(16%) fertile-viable cysts were found out of 142 cysts recorded during study period. Beyond other limiting factors that hinder route of transmission of the disease, naturally infertile cysts were many in number than fertile cysts, which is also one of the limiting factor to reduce prevalence of hydatidosis, otherwise it could have been more than expected, had it been all cysts were fertile.

Table 4 displays the distribution of different status of hydatid cysts. Fertile-viable, fertile-dead, non-fertile or sterile and calcified hydatid cysts were observed in different organ with various frequencies. Out of the organs examined, the highest proportion of the fertile-viable cyst were observed in the heart 4 (40%) followed by lung 15 (17%), kidney 3(11.1%) and liver two (10.2%), whereas fertile-dead hydatid cyst were observed in the kidney 4 (40%) and heart four (40%) followed by lung 20(23%) and liver one (5.2%), accordingly. During observation the highest proportion of the non-fertile or

Table 4: Proportion of organs infected and viability of hydatid cyst in different organs

| Organ | № positive | № calcified | № fertile | | № non-fertile |
|---|---|---|---|---|---|
| | | | Dead | Viable | |
| Lung | 87 | 6 (6.9) | 20 (23) | 15 (17.2) | 46 (52.9) |
| Liver | 19 | 13 (68.4) | 1 (5.2) | 2 (10.2) | 3 (15.8) |
| Heart | 10 | 0 | 4 (40) | 4 (40) | 2 (20) |
| Kidney | 21 | 3 (11.1) | 4 (40) | 3 (11.1) | 11 (52.3) |
| Spleen | 5 | 5 (100) | 0 | 0 | 0 |
| Total | 142 | 27(19.0) | 29(20.4) | 24(16.9) | 62(43.7) |

sterile cyst observed in the lung and kidney. Calcified hydatid cyst was higher in spleen followed by liver, kidney and lung as shown in the Table 4 below.

## DISCUSSION

Hydatid disease is an important medical and veterinary problem in the world and considered to be an endemic disease in Ethiopia. Domestic intermediate hosts (cattle, sheep, goats and buffaloes) are major reservoirs for the disease in humans. The widespread distribution and nature of the life cycle of *E. granulosus* suggest that there will always be a risk of re-introducing the cestoda as long as live animals are imported [13].

In this study, the prevalence of hydatidosis in cattle slaughtered at Sebeta municipal abattoir was 24.6%, which was similar to 22.1% as reported by [14]; but lower as compared to 53.5% prevalence in Assela reported by Ararso [15] and 32.1% as reported by Gebretsadik Berhe [16], there were reports lower than the current findings like 15.0% in Gondor by Mezgabu [17 and 6.6% in Nazareth by Yemane [18]. Possible reason for the difference in the prevalence of hydatidosis might be due to the opportunity created contact between final host feaces and intermediate host in the study area; the other point could be the duration of study period and sampling site and procedure could affect the prevalence. Dogs, which are the primary predisposing factor for the disease transmission are used as guards for herders and are routinely fed with uncooked offal, which deemed unfit for human consumption [17].

The prevalence of hydatidosis in cattle slaughtered at Sebeta municipal abattoir from Addis Ababa surrounding was 29.2%, from Shewa zone was 25.3%, from Western region 13%, which has indicated that there was a gradual reduction in prevalence as it go far away from Addis Ababa this might be associated with the concentration of dog population around Addis Ababa than other sites. However, prevalence isstill higher in small towns as it was reported by Wubet [19] 63% in robe; Alemayehu [20] reported 54.8% in the Arsi region; Yilma [21] recorded 46.5% bovine. Despite variation in prevalence, it indicates that there is a favorable epidemiological environment for the sustainable life cycle of the parasite, where there is a strong linkage between dogs and cattle, the traditional way of dog keeping and provision of raw offal's, that is unfit for human consumption has created good opportunity to maintain lifecycle of the parasite. The problem seems to continue for the future unless countrywide control strategy implemented.

The general trend of age prevalence shows that, the infection increase as the age of animals' increases, where age group 3-5 years old had 20%, 6-10years old had 22.8% and greater than 10 years old were 42.5%. As reported by Regassa *et al*. [22] animals above five years old had significantly high prevalence than below five years of age. The reason behind this might be older animals may gain access more repeatedly on the field which will results the opportunity to be infected in their life time as compared to the younger age groups, where they are exposed shorter period than old age groups.

Body condition significantly indicates the prevalence of hydatidosis in the present study ($p< 0.05$) and those animals with poor body condition showed higher prevalence of echinococcosis. Different workers [14, 16, 23-25] observed similar result which is in agreement with the present study. The differences between body conditions score may be due to animals with poor body condition have low immunity to protect itself from hydatid cyst disease as described by Thompson and Allsopp [26], where the number of egg ingested develops into hydatid cyst depends on the immune status of the animals.

The present study in Sebeta municipal abattoir showed that the lung was more frequently infected than kidney, liver, heart and spleen with the prevalence of 61.3%, 14.8%, 13.3%, 7%, 5%, respectively in cattle. This finding is in agreement with the result of Kebede *et al*. [14] which revealed that most of the infected cattle

showed (66.7%) hydatid cyst in lung and livers. Giannetto *et al*. [27] in Sicily and by Azlaf and Dakkak [2] also reported similar prevalence in Morocco and by Regassa *et al*. [22] who has reported 35.44% in both lungs and livers. The lung and liver are the most commonly affected organs. This could be due to the fact that the lungs and livers posses the first great capillaries sites encountered by migrating echinococcus oncospheres (hexacanth embryo) which adopt the portal vein route and primary negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved. In addition, the lungs where predominantly infected with hydatid cyst than other organs probably due to the presence of greater capillary beds in the lung than other organs which is in agreement with Kebede *et al*. [14]. The kidney, heart and spleen are the least affected organs in the study animal. Various workers also agreed with the concepts anatomical and physiological nature of these two organ, where blood irrigation comes from bilaterally that provide more chance to reach in this organs and blood vessels are widely ramified which gives opportunity for the oncospheres to lodge into small vessels [28] and Getaw *et al*. [29]. Whereas, development hydatid cyst occurs occasionally in other organs and tissue because blood supply is one source and all blood comes to kidney, heart, spleen after filtration in the lung, therefore the overleaf ones are lodged in other organs after the oncospheres reach into the general systemic circulation [30]. Asrat [31] in South Wollo, Ethiopia obtained similar findings. In addition to aforementioned ideas these organs might be relatively soft consistency of the lung, which allows easily growth of cysts. Similarly, in the rare sites such as abdominal cavity, where unrestricted growth is possible, the hydatid may grow very large and contain several liters of fluid [1, 30].

On the other hand, the proportion of fertile-viable cyst is lesser than sterile, non viable and calcified cysts. The finding is similar with that of Kebede *et al*., Gebretsadik and Regassa *et al*. [14, 16, 22] This low proportion might be due to host defense system.

Survey conducted on hydatidosis by Kebede *et al*. [14] in the definite host (dogs) in different sites of Mekele town revealed the occurrence of the adult parasite *E. granulosus* in small intestine of dogs. Out of examined 16.7% were positive for the presence of adult parasite. The dog is most likely the principal source of both human and animals' echinococcosis in Ethiopia as indicated in several studies in dogs in the country. Therefore, it is wise to design countrywide strategy in order to control the disease in question, which has high economic and zoonotic importance. Education of the community how to manage dogs and other strategy should be in place promptly.

## CONCLUSION

Echinococcosis is one of the most important parasitic diseases with economic and public health significance. The result of current and past studies indicates the existences of higher prevalence of hydatid cyst in different parts of country. The study also has indicated that old age group had high prevalence than relatively younger ones and poorly conditioned were also infected more than good body condition. Therefore; the problem brings about effect on the productivity of animals due to physiological interference. In Ethiopia, the prevalence of echinococcosis is directly associated with keeping dogs in close association with animals and humans are the most common practice where supported by providing infected offal's; which maintains the lifecycle of the parasite in order to exist for years. As clinical findings are hard to see implicitly, the diagnosis should be achieved by taking into consideration the clinical aspects, the epidemiology of the disease, the imaging and immunological tests. Based on the conclusion the following recommendations are forwarded:

- The problem seems to continue for the future unless countrywide control strategy designed
- Execution and implementation of control strategy has to be put into practice
- Keeping dogs in close association with animals and humans should be supported with regular treatment.
- Feeding of infected offals to dogs and canine species should be avoided and all infected visceral organs should be buried properly.
- Reduction of stray dogs' population to reduce the risk of hydatidosis to animals and humans very important.
- Further studies on prevalence of hydatidosis should be encouraged to design countrywide control measures.

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