

Prevalence and Financial Loss Due to Bovine Hydatidosis at Municipality Abattoir of Jimma, Ethiopia

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Abstract: The study was conducted from November 2009 to March 2010, at Jimma municipal abattoir with the aim of determining the prevalence of bovine Hydatidosis and estimating associated financial loss of the study area. Out of 512 randomly selected cattle, 226 (44.14%) were found infected with hydatid cyst, that harboring one or more cysts involving different visceral organs (Lung, liver, heart, spleen and kidney). From a total of 308 organs found affected the overall involvement of lung and liver account for 98.05% (302/308). This shows high prevalence of Hydatidosis in the specific study area. The direct annual financial loss from organ condemnation at the Jimma municipal abattoir was estimated to be about 262,198.89 ETB and the indirect financial loss due to carcass weight loss was also calculated to be about 52,557.498 ETB. The total annual financial loss was calculated to be 314,756.388 ETB. 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 preventive measures need to be taken in order to minimize the financial loss associated with the problem and to prevent the zoonotic risk to the public.

Key words: Hydatidosis • Bovine • Prevalence • Financial Loss • Jimma

INTRODUCTION

Ethiopia covers several ecological zones with wide natural resources. Many of which are favorable for various species of animals. It has livestock population over 47.57 million of cattle, 47.83 million of sheep and goats, 7.73 million of equines, over 1 million of camels and 39.6 million of poultry according to 2007/08 agricultural sample survey report of central statistics agency of Ethiopia [1]. Livestock productivity remains marginal in Ethiopia due to many factors like malnutrition, management problem, prevalent disease, etc. Among these hydatidosis is one of the important parasitic disease of livestock that has both economic and public health significance [2].

Hydatidosis /Cystic Echinococcosis is a parasitic infection caused by the larval stage of *Echinococcus granulosus*, which is a small tapeworm, for which dogs and other canids are typical definitive hosts. The adult parasite is found in the small intestine of carnivores while the *metacestode* (Hydatid cyst) is found in different organs of wide variety of herbivores including sheep, goat, cattle, pig, horse and man. The adult tapeworm is

comparatively harmless to the dog although in large numbers enteritis may be seen but its larval stage, hydatid cyst, is a disease of immense medical and economic importance [3]. Ungulates and Human become infected by accidental ingestion of oncospheres from contaminated food, water and environments, where as the dog is the commonest final host of *E. granulosus*, which becomes infected by ingestion of infected offal's [4]. Infection in human is much more common on the rural areas of Ethiopia where dogs and domestic animals live in a very close association usually sharing the same accommodation with human [5].

In Ethiopia Hydatidosis has been known and documented as early as 1970 in animals and in 1972 in humans. From records collected over three years period, 17 human hospital cases of hydatid disease were recorded in the 1970 and latter in the 1980's hyper endemic foci of hydatid disease was made known in the lower Omo river basin in the south western part of country [6]. Different studies showed different prevalence in different parts of the country. Nevertheless, current information on the status of Hydatidosis in Jima is not available. Therefore,

the objectives of this study are to determine the prevalence of Hydatidosis, to estimate the financial loss resulting from organ condemnation, to determine cyst fertility and viability rate of the study area.

MATERIALS AND METHODS

Study Area: The study was conducted in Jimma town municipality abattoir. Jimma town is the capital of Jimma zone which found in Oromia Regional Administration; 352 km south west of Addis Ababa with the population of the town according to the census of 2007 is 120,960 of which about 60,824 are male and the rest 60,680 females [7]. It is geographically located at altitude of about 7°41' N and 36°50' E and at an elevation ranging from 880 m to 3360 m above sea level. The area receives a mean annual rain fall of about 1530 millimeters which comes from the long and short rainy seasons. The annual mean minimum and maximum temperature during the study period were 14.4 and 26.7 °C respectively [1].

Study Design: A cross-sectional study carried out from November, 2009 to April, 2010 by collecting data on events associated with Hydatidosis in cattle slaughtered at Jimma municipality abattoir study population: The study was conducted on 512 local breed cattle originated from different woredas surrounding Jimma town such as Gomma, Seka and half of Jimma town (Categorized as western district) and Dedo, Karsa and half of Jimma town (Categorized as eastern district).

Sample Size Determination: The sample size was determined by simple random sampling method using 95% confidence interval at a desired absolute 5% precession [8]. The total required sample size was 384 animals, However to increase the precision of estimates it was increased to 512 animals.

Sampling Strategy: All 512 animals required for the study were selected using systematic random sampling. This was accomplished by selecting three slaughtering days per week. A visit was made at Jimma municipal abattoir on these selected days and postmortem inspection was conducted.

Preliminary Data Collection: During ante mortem inspection each of the study animals were given an identification (ID) number, age, sex and body condition score of the study was also recorded. Estimation of age was done by the examination of the teeth eruption using the approach forwarded by De-Lahunta and Habel [9].

Two age groups were considered; less or equal to five years and above five years. Since all the cattle presented to slaughtering in the study area were male and the animals were mainly bought from the market generally, due to this reason their specific origin was not recorded. Therefore infection rate regarding to origin and sex variation was not included. The body condition scoring was classified in to three categories at lean or poor (1, 2, 3), medium (4, 5, 6) and fat or good (7, 8, 9) based on Nicholson and Butterworth [10].

Postmortem Examination: Postmortem examination was done by inspection, palpation and incision of visceral organs (lung, liver, heart, spleen and kidney) was made and the rate of infection of Hydatidosis and the organ distribution were recorded. Post-mortem inspection of slaughtered cattle and hydatid cyst characterization was made to assess the overall prevalence of the disease and status of the cysts, respectively. Visceral organs particularly lung, heart, liver, spleen and kidney were inspected thoroughly by visualization, palpation and incision for the presence of hydatid cyst and recorded. Hydatid cysts were carefully removed and separately collected (in organ bases) in clean containers for farther cyst characterization [11].

Cyst Characterization: The size of the hydatid cysts on affected organs was measured using the approach forwarded by Schantz [12]. According, the cysts were measured systematically and classified in to three groups based on their diameter as small (<4 cm), medium (4-8 cm) and large (>8 cm). Cyst Fertility determined where the cyst was fertile or sterile by using the method recommended by Macpherson [13]. For the presence of protoscolices either attached to the germinal layer in the form of brood capsule or its presence in the cyst and vice versa. Only fertile cysts had been considered to propagate the infection. Thus, fertile cysts were subjected to viability test. Both fertility and viability of hydatid cysts were determined by the method mentioned above.

Economic Loss Assessment: Direct loss due to Organ Condemnation: The economic loss due to total or partial condemnation of organs due to hydatidosis can be assessed according to the formula set by Orgunriade and Ogunrindade [14].

Indirect Loss Due to Carcass Condemnation: A 5% carcass weight loss due to Hydatidosis in cattle has been described by Yugoslavian investigator [15]. Retail market

price condemned organs was assessed based on information from local butchers. Then annual economic loss was calculated interims of Ethiopian birr by adding both direct and indirect loss.

Data Analysis: The data collected were entered in to Microsoft Excel Data base system. Data were analyzed using STAT 7 intercoded statistical software. The prevalence rate was calculated by dividing the proportion of cattle infected with hydatid cyst (The finding of at least one hydatid cyst in the viscera) by the total number of animals examined multiplied by 100. The determinants of hydatidosis were investigated using percent values and Pearson's chi-square (χ^2). A statistically significant association between variables was said to exist if the calculated $P < 0.05$ at 95% confidence level (CI). The direct and indirect financial losses were calculated in accordance with Orgunriade and Ogunrindade [14] and Polydorou [15] respectively.

RESULTS

Prevalence

Overall Prevalence: Out of a total of 512 randomly selected and examined, 226 (44.14%; 95 CI: 39.79%-48.56%) cattle were found infected with hydatid cyst, harboring one or more cysts involving different visceral organs (lung, liver, heart, spleen, kidney).

Age and Prevalence: Rate of infection in different age groups of cattle (≤ 5 and > 5 years) were assessed (Table-1) and the prevalence between the age groups was statistically insignificant ($P > 0.05$).

Body Condition Score and Prevalence: The prevalence was also assessed in terms of body condition score and it was found that cattle having medium body condition score had the highest prevalence rate (50%), followed by good or fatty body condition with prevalence rate (42.62%) and poor or lean (39.13%). But the difference in prevalence rate among the body condition scores was statistically insignificant ($P > 0.05$) (Table-2).

Distribution of Hydatid Cysts in Different Organs: Out of the total 226 infected cattle, 104(20.31%) had hydatid cysts in their lung only, 22(4.9%) in liver only, 2(0.4%) in kidney only, 95(18.55%) found in both lung and liver, 2(0.4%) found in lung, liver and spleen, 1(0.195%) found in heart, lung, liver and spleen (Table-3). From a total of 308 organs found affected the overall involvement of lung and liver account for 98.05% (302/308).

Table 1: Comparison of Hydatidosis among different age groups

Age	No of animals		Prevalence	χ^2 -Value	P-value
	Examined	Positive			
≤ 5 years	99	38	38.38%	1.6494	0.199
> 5 years	225	188	45.52%		
Total	512	226	44.14%		

Table 2: Prevalence in body condition score

Body condition	No of animals		Prevalence	χ^2 -Value	P-value
	Examined	Positive			
Lean	69	27	39.13%	2.9089	0.234
Medium	138	69	50.00%		
Fat	175	130	42.62%		
Total	512	226	44.14%		

Table 3: Summary of hydatid cysts distribution in different organs

Organs	No of animals		% From Inspected	% From Infected
	Examined	Positive		
Lung	512	104	20.31	46.08
Liver	512	22	4.90	9.73
Heart	512	0	0.00	0.00
Spleen	512	0	0.00	0.00
Kidney	512	2	0.40	0.88
Lung & Liver	512	95	18.55	42.04
Lung, Liver & spleen	512	2	0.40	0.88
Lung, Liver, Heart & Spleen	512	1	0.19	0.44
Total	512	226	44.14	100

Cyst Characterization: From the total of 668 cysts 614 cysts were taken to laboratory for farther cyst characterization and the left 54 cysts were calcified.

Size of the Cysts: The systemic measurement of cysts revealed that a higher number of small sized cysts 348(56.31%) followed by medium size 183(29.6%) and large sized cysts 83(13.43%) (Table - 4).

Cyst Fertility Rate: Out of the total 226 positive cases only 174 cysts that organs with fluid field cysts were examined for the fertility and 54 cases found as calcified. Generally 106(46.9%) cysts were sterile, 68(30.09%) cysts were fertile and 54(23.01%) cysts were found. Out of the total 68 fertile cysts 18(26.5%) of the cysts were viable and the remaining 50(73.53%) cysts were dead (Table-5).

Estimation of Financial Loss

Financial Loss Due to Organ Condemnation (Direct Loss): All organs that affected with fluid filed hydatid cysts totally 182 lungs, 87 liver, 1 heart 3 spleen and 1 kidney were condemned totally and organs that affected with calcified cysts totally 20 lungs, 33 livers and 1 kidney

Table 4: Systemic measurement of the cysts size

Organs	No of cysts			Total
	Small Sized	Medium Sized	Large Sized	
Heart	0(0.00%)	2(1.09%)	0(0.00%)	2(0.324%)
Lung	105(30.17%)	103(56.28%)	79(95.18%)	287(46.44%)
Liver	240(68.96%)	75(40.98%)	1(1.20%)	316(51.13%)
Spleen	2(0.57%)	2(1.09%)	2(2.41%)	6(0.97%)
Kidney	1(0.287%)	1(0.55%)	1(1.20%)	3(0.50%)
Total	348(56.31%)	183(29.6%)	83(13.43%)	614(100%)

Table 5: Cysts fertility rate among infected organs

Organ	Condition of Cysts			Total
	Fertile	Sterile	Calcified	
Heart	0.00%	0.44%	0.00%	
Lung	38.08%	44.25%	8.85%	
Liver	13.71%	25.22%	14.60%	
Spleen	0.00%	1.327%	0.00%	
Kidney	0.00%	0.44%	0.44%	
Total	68 (30.09%)	106 (46.9%)	53 (23.01%)	

Cyst Viability rate: Out of 68 fertile cysts 18 (26.5%) were viable and the rest 50 (73.53%) cases were dead.

Table 6: Organ condemnation rate and its current price in Jimma town

Organ	Percentage of infection	Current price in ETB
Lung	89.38	10
Liver	53.10	42
Heart	0.44	15
Spleen	1.32	5
Kidney	0.88	7
Total	44.14	80

Table 7: Summary of annual financial loss

Organ	Lung	Liver	Heart	Spleen	Kidney	Carcass weight loss
No of organs condemned totally	182	87	1	3	1	52,557.498
Cost of total condemnation	1,820	3,654	15	15	7	
No of organs condemned partially	20	33	0	0	1	
Cost of total partial condemnation	100	1,386	0	0	3.50	
Total loss from the sampled animals	1,920	5,040	15	15	10.50	
Computed annual loss from condemnation	74,564.91	186,018.50	550.60	551.85	513	
Total direct loss due to organ condemnation = 262,198.89 ETB						
Grand total = 314,756.388 ETB						

were condemned partially due to hydatidosis. When this calculated as 1,920, 5,040, 15, 15 and 10.5 ETB lost from each organ respectively, to a total of 7,135.5 ETB. This was computed from the average market price of cattle lung (10 Birr), liver (42 Birr), heart (15 Birr), spleen (3 Birr) and one kidney (7 Birr) in Jimma town and the total number of organs condemned from the sampled cattle during the study period (Table - 6). On the other hand, annual financial loss was determined by considering annual slaughter rate of cattle at Jimma municipal abattoir, overall prevalence of hydatidosis and percentage involvement of liver, lung, heart, spleen and kidney.

Accordingly, it was calculated to be 262,198.89 ETB annually (Table - 7).

Financial Loss Due to Carcass Weight Loss or Indirect Loss: A 5% carcass weight loss due to hydatidosis [16] was considered as the information given previously to estimate the economic loss. The calculated result showed a loss of 52,557.498 ETB per annum.

Grand Total Estimated Financial Loss: in cattle slaughtered at Jimma municipal abattoir due to Hydatidosis was estimated to be direct loss plus indirect loss equal to 314,756.388 ETB (Table-7).

DISCUSSION

In this study of bovine Hydatidosis the prevalence recorded as 44.14%, a finding very close to 42.9% that recorded in Melgewondo by Getahun [17] and 44.27% observed in Assela by Kifle [18]. Other comparable observations were also made in different regions, 46.5% prevalence in Debre-zeit by Yilma [19]. Still high prevalence (63%) was also registered in Robe by Wubet [20]. The high prevalence may be generally related to the prevalence of favorable factor for the propagation and maintenance of high level of infection in the area. The prevalence by age revealed that higher infection was recorded in animals with age above five years (45.52%) and followed by those less than or equal to five years (38.38%). The differences in prevalence rate between the two age groups were statistically insignificant ($P>0.05$). The reason to this age difference rate of infection is established the fact that the prevalence of hydatid cyst increases as the age of the animals increased [16]. The study also shown lung is more frequently affected than liver 39.45% and 23.44% respectively. This figure has agreed with the result of Kifle [18] which indicate 33.85% of lung and 22.66% of liver, Mohamed [21] 69.5% and 30.5% of lung and liver respectively. The reason for these phenomena probably could be because of cattle are slaughtered when they become aged at which the diameter of the capillary increased [22]. As to the infectivity rate of hydatid cyst during the study period as lower percentage of fertility was identified (30.5%) out of the total cyst examined and relatively high percentage (44.247%) and (23.9%) of the total cysts were found sterile and calcified respectively. The reason for this variation of infectivity stated by Aren that strain of parasite and host can modify the infectivity of the parasites [23].

The total annual financial loss incurred due to bovine hydatidosis at Jimma municipal abattoir from lung and liver condemnation was estimated to be about 314,756.388 ETB. Similarly different financial loss regarding to bovine hydatidosis were also reported from different parts the country. For instance, Yilma [19] reported on annual loss of 813,526.46 ETB at Debre-zeit abattoir, Kifle [18] reported on annual loss of 20,570.68 ETB at Assela municipal abattoir. This difference of the result in various abattoir or regions may be due to the variation in the prevalence of the disease, mean annual slaughtered cattle in different abattoir and variation in the retail market price of liver and lungs. Since hydatidosis has adverse effect on the livestock production sector, for it cause huge financial losses, the interpretation must be made with a

very serious, precautions, particularly in slight of the fact that in Jimma area only few animals are brought to the abattoir that there is tradition in back-yard and road-side slaughtering, therefore; calculated percent loss is generally considered as by far lower than the real loss by bovine Hydatidosis.

CONCLUSION

Hydatidosis, which causes a considerable loss to livestock industry is also a serious threat to public health and is highly prevalent in cattle slaughtered at Jimma Municipal Abattoir. The abattoir didn't have a proper waste disposal system to dispose organs harboring different lesions and cysts including GIT contents. Such kind of practice enhancing the continuation of the cycle between the intermediate and final hosts (dogs) and further may increase the risk of zoonotic infections to human beings residing in and around Jimma town. Moreover, backyard slaughtering system, the high population of stray dogs and the relations existing between livestock and pet animals, the nil emphasis given to the health of pet animals are the main factors that may have contribution to this increasing prevalence and distribution of the disease. It is therefore, concluded that owing to the presence socio-economic condition favorable for the study area and considering the in calculably remained organs and indirect loss from it, Hydatidosis is one of the most economically important disease in Jimma and its surrounding, warranting serious attention for its control and preventions.

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