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Epidemiology and Financial Loss of Bovine Hydatidosis in Cattle Slaughtered at Nekemte Municipal Abattoir, Ethiopia

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Abstract: A cross-sectional study was conducted from November 2010 to march 2012 to estimate the prevalence and risk factors associated with the hydatidosis and estimate the financial annual loss incurred due to the disease in cattle slaughtered at Nekemte municipal abattoir. Among the total of 539 cattle examined, 98(18.2%) of them had harbored hydatid cyst(s) in one or more of their offals. From the total of 378 hydatid cysts collected and characterized, 202(53.4%), 163(43.1%), 7(1.9%), 4(1.1%), 2(0.5%) of them were obtained from liver, lung, spleen, kidney and heart, respectively. Of the collected cysts, 159(42.1 %) and 87 (23.02 %) were found to be calcified and fertile, respectively. Among the 87 fertile cysts, 44(50.6) were viable. There was statistically significant association between the body condition of the cattle and the occurrence of hydatidosis (X^2=16.337; P<0.05). The estimated annual financial loss incurred due to condemnation of organs and indirect carcass weight loss from hydatidosis was found to be 662,084 ETB. In conclusion, the study indicated that hydatidosis is economically important disease with implication for public health calling for urgent intervention. Public awareness about the epidemiology of the disease and application of the conventional preventive and control measures like detail meat inspection, proper disposal of infected organs and control of stray dogs are recommended to control the disease.

Key words: Cattle · Hydatidosis · Prevalence · Financial Loss · Nekemte · Ethiopia

INTRODUCTION

Cystic Echinococcosis (CE) is a zoonotic parasitic infection of many mammalian species and humans caused by the metacestode of *Echinococcus granulosus*, which is found in the small intestines of dogs and other carnivores [1-5]. It occurs throughout the world and causes considerable economic losses and public health problems in many countries [2]. The prevalence of the disease is higher in developing countries especially in rural communities where there is close contact between dogs (definitive host) and where livestock production is based mainly on extensive grazing system [4].

In Ethiopia, hydatid disease has been noted since the 1970's [5]. The absence of proper meat inspection procedures and the presence of large stray dog population are thought to contribute significantly to the prevalence of the disease in Ethiopia [6]. Reports from different parts of the country revealed that hydatidosis is a wide spread disease with great economic and public health significance [7- 10].

Few studies conducted at Nekemte municipal abattoir in the past indicated the prevalence of the disease to be 31.19% [9] and 36% [8]. However, there is no current information regarding the status of the disease. Knowledge on the current prevalence, associated risk

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factors and financial impact of the disease is essential to initiate cost effective and locally adaptable preventive and control measures. Therefore, investigation of the current epidemiological status and financial impact of the disease in the study area is a timely important. To that end, the study was designed with the objectives to estimate the prevalence, associated risk factors of hydatidosis and estimate annual financial loss incurred due to the disease in cattle slaughtered at Nekemte municipal abattoir.

MATERIALS AND METHODS

Study Area: This study was conducted from November 2010 to March 2011 in Nekemte town, the capital city of Eastern Wollega zone located at 331 km to the west of Addis Ababa. The town is located at an elevation of 2134 meter above sea level and the longitude and latitude of the area is 36 °33 'East and 9 °5 ' North, respectively. The area receives an annual range of rain fall from 1500-2200 mm and gets temperature range of 10-31°c. Crop-livestock production is the main livelihood for more than 90% of the population [11].

Study Design : A cross sectional study design based on active abattoir and retrospective survey was employed.

Study Population: The study population was cattle brought for slaughter from different areas of the zone to Nekemte municipal abattoir.

Sample Size and Sampling: The total number of cattle required for the study was calculated using the formula given by Thrusfield [12]. The sample size was determined based on expected prevalence of 31.19% [9] reported around Nekemte, 5% accepted level of precision and 95% confidence interval. Accordingly, a minimum sample size required for the study was calculated to be 330 cattle. But, to increase the precision, the sample size was inflated to 539. The study cattle were randomly selected and included in the study from all animals brought for slaughter at Nekemte municipal abattoir. Potential risk factors like age, sex, breed, origin and body condition scoring were recorded [13].

Examination and Characterization of Cysts: In the abattoir, each organ of the slaughtered animals particularly lung, liver, heart, spleen and kidney were examined by visual inspection, palpation and incisions where necessary. Individual cysts were grossly examined for evidence of calcification and active cysts were collected and examined for further fertility, sterility, viability tests and determination of cyst size according to the recommended procedures [14].

Estimation of Financial Loss: An attempt was made to estimate the financial losses incurred due to cattle hydatidosis from the cost of condemned offal's and carcass weight loss. Financial losses were assessed based on both active and five years retrospective surveys. Annual financial loss due to organ condemnation was determined based on annual number of cattle slaughtered, average price of each organ and carcass per kg, prevalence of hydatidosis per organ and an estimated 5% carcass weight loss[15]. Average carcass weight of Ethiopian local breed cattle is estimated as 126 kg [8, 16]. The total financial loss was calculated as the summation of cost of offal condemned plus the cost of carcass weight losses [15].

Data Management and Analysis: The data was entered into MS Excel spread sheets and analyzed using SPSS version 11.5statistical software. Descriptive statistics such as percentages and frequency distribution was used to describe the nature and the characteristics of the data. Chi square test was used to see association of risk factors with the prevalence of hydatidosis. P value less than 0.05 was taken as level of significance.

RESULTS

From the total of 539 cattle slaughtered and examined, 98 (18.2 %) of them were found harboring hydatid cyst (s) in one or more of their offal. Among the risk factors considered, only the body condition of the cattle was statistically associated with the prevalence of bovine hydatidosis(X^2=16.337; P=0.001) Table 1

From the total of 539 examined cattle, 120 different visceral organs harboring 378 hydatid cysts were observed. More than half of the hydatid cysts, 202 (53.4 %) were obtained from liver followed by lung 163 (43.1%) in comparison to other visceral organs (Table 2).

Most of the cysts were found to be calcified 159 (42.1%) and medium 89(23.5 %)in size. Systematic measurement of the cyst size revealed that a high number of large and medium sized cysts were found on lungs; while a higher number small sized and calcified cysts were found on the liver (Table 3).

Table 1: Prevalence of hydatidosis based on different risk factors at Nekemte municipal abattoir.

Variable	No. examined	No. positive	Prevalence	95% CI	X^2	P value
Age						
≤5	42	2	4.8	1.5-8.1	5.548	0.062
(5-8]	330	63	19.1	17.6-21.3		
>8	167	33	19.8	17.0-23		
Sex						
Female	17	4	23.53	12.8-33.8	0.337	0.561
Male	522	94	18.00	16.3-19.7		
BCS						
Lean	14	5	35.71	22.9-84.2	16.337	0.001
Medium	24	11	45.8	35.6-56.0		
Fat	501	82	16.37	14.8-18.1		
Origin						
Bandra	120	25	20.8	17.1-24.5	11.081	0.135
Arjo	59	9	15.3	10.6-20.0		
A/Gudatu	108	21	19.4	15.6-23.2		
Diga	59	16	27.1	21.3-32.9		
Getema	57	9	15.8	11.0-20.6		
Sasiga	39	0	0.0	0.0-0.0		
Uke	70	8	11.4	7.6-15.2		
Nekemte	47	10	21.3	15.3-27.3		
Total	539	98	18.2	16.3-19.9		

Table 2: Distribution of hydatid cyst in different visceral organs of infected cattle slaughtered at Nekemte municipal abattoir.

Affected organ	Number	Percent	95% CI
Liver	202	53.4	51.0-56.0
Lung	163	43.1	40.6-45.7
Kidney, spleen and heart	13	3.4	2.5-4.4
Total	378	100.0	

Table 3: Size and proportion of cysts on different visceral organs

	Cyst distribution					
Cyst size	Liver	Lung	Kidney	Spleen	Heart	Total
Large	9(4.5)	48(29.4)	0(0.0)	4(57.1)	0(0.0)	61(5.6)
Medium	20(9.9)	68(41.7)	0(0.0)	1(14.3)	0(0.0)	89(23.5)
Small	30(14.9)	32(19.3)	4(100.0)	1(14.3)	2(100.0)	69(18.3)
Calcified	143(70.8)	15(9.2)	0(0.0)	1(14.3)	0(0.0)	159(42.1)
Total	202	163	4	7	2	378

Table 4: Type and distribution of the hydatid cysts in different visceral organs

	Organ distribution					
Cyst condition	Liver %	Lung %	Kidney%	Spleen%	Heart%	Total
Sterile	32(15.8)	89(54.6)	4(100.0)	5(71.4)	2(100.0)	132(34.9)
Fertile	27(13.4)	59(36.2)	0(0.0)	1(14.3)	0(0.0)	87(23.0)
Calcified	143(70.8)	15(9.2)	0(0.0)	1(14.3)	0(0.0)	159(42.1)
Total	202	163	4	7	2	378

Table 5: Distribution and proportion of viable cysts indifferent visceral organs

Organ	Fertile	Viable	Total
Liver	18(66.7)	9(33.3)	27
Lung	24(40.7)	35(59.3)	59
Spleen	1(100.0)	0(0.0)	1
Total	43(49.4)	44(50.6)	87

From the total 378 cysts characterized for their fertility status, 87 (23.02 %) were fertile of which 44 (50.6 %) were proved to be viable. Larger proportion of fertile cysts 59(15.6 %) and viable cysts 35(59.3%) were obtained from lung compared to other organs (Table 4 and 5).

Estimation of Financial Loss: The total annual financial loss attributed to hydatidosis was estimated to be 662,084.00ETB of which 459,222.00ETB and 202,862.00 ETB was due to direct organ condemnation and carcass weight loss, respectively.

DISCUSSION

The current study revealed that the prevalence of bovine hydatidosis in cattle slaughtered at Nekemte municipal abattoir was found to be18.2%. The finding is relatively comparable with the prevalence of 22.4% in Jimma [17], 22.6 % in Konso [18] and 20.3% in Debremarkos [19]. Comparable findings of bovine hydatidosis were also reported from Morocco and Kenya in which the prevalence of 23.0 % [20] and 19.4% [21] were recorded, respectively. However, it is lower than the previous reports of the same area 31.2 % [9] and 36.0 % [8] and other parts of the country, 52.6 % in Hawassa [22]. Relatively the current prevalence finding is higher than the 7.5% prevalence report in Harrargie region [23]. The variation of the prevalence of hydatidosis among different geographical locations could be associated with the strain difference of *Echinococcus granulosus* that exist in different geographical locations, age of the animals and other factors like socio-economic activities and management of dogs in different region [24, 25].

Among the factors considered (age, sex, body condition and origin), only the body condition of the cattle was statistically associated with the occurrence of the disease ($P<0.05$). Cattle having lean and medium body conditions were found to have higher cysts burden which can be explained due to the retarded growth, weight loss and moderate to severe infection in such animals as described by Polydorous [15]. In present study the prevalence of hydatidosis seems to increases as the animal's age advances. The finding is in agreement with the findings of other researchers where they reported a higher prevalence in older animals [20, 22]. This could be mainly due to the fact that aged animals have longer exposure time to *Echinococcus granulosus* eggs and weaker immunity to resist the infection [26]. Moreover, most of the slaughtered animals were less productive and culled animals which have increased chance of acquiring the infections. There was no significant difference in the prevalence of the disease among animals from the different regions. This could be due to the similarity in socio-economic status and animal's husbandry practices of community in the study area [4].

The largest number of cysts were collected from liver (53.4%), followed by lung (43.1%). This finding was similar to the findings [18, 27, 28) who reported large number of cysts from liver compared to other organs. The liver infection may be a reflection of the route of parasite entry and seems to support the hypothesis that hepatic portal distribution of the onchospheres leading to liver infection [29]. The finding that lung and liver are the most commonly infected organs could be due to the fact that lungs and livers possess the first great capillaries of sites encountered by migrating Echinocooccus onchosphere (hexacanth embryo) which adopt the portal vein route, the first large capillaries encountered by migrating blood borne onchospheres and primarily negotiate pulmonary and hepatic filtering system sequentially before any other organ is involved. However, development of hydatid cysts occurs occasionally in other organs like spleen, kidney and heart and other organs and tissues when onchospherers escaped into general systemic circulation [29].

Liver harbors highest number (70.8%) of calcified and high number of (14.9%) small sized cysts. This could be attributed to relatively high reticuloendothelial cells and abundant connective tissue reaction of the liver [30]. Highest numbers of medium and large sized cysts were found on the lung and spleen than any other organ. This might attributable to the softer consistency of lung tissues which allows easier development of the pressure of the cyst [31, 32].

In this study 23.02% of the cysts were fertile and 44 (50.57 %) of the fertile cysts were proved to be viable. This was relatively comparable with the findings of Zelalem [33] and Alembante [22] who reported the fertility rate of 26.9 % and 19.3%) respectively. But, it is lower as compared to the reports from Niger Delta 70.0% [34] and much higher than report of 1.76% around Wolayita Soddo [35], 9.85% in Nekemte [8] and 6.2% in Bahir Dar [36]. The fertility rate was higher for lung (36.2%) followed by

liver (13.4%) while cysts in the other organs were almost sterile. This may be due to the softer consistency of the lung tissue which may allow the easier development of the cyst. The fertility rate of hydatid cyst may show a tendency to increase with advancing age of the hosts [26]. The variation in fertility, sterility and calcification in different areas could be strain difference [34].

The financial loss incurred by hydatidosis per annum was estimated to be 662,084.00 ETB which is relatively comparable with report from Gondar by Endalew and Nuradddis [37] where they estimated the annual loss of 674,093.038 ETB. This shows that hydatidosis is economically an important disease of cattle in the study area.

In conclusion, the study revealed that hydatidosis is an economically important diseases with an implication for public health. The authors recommended that public awareness about the epidemiology of the disease and application of the conventional preventive and control measures like detail meat inspection, proper disposal of infected organs and control of stray dogs so to break the life cycle of the parasite.

REFERENCES

1. Craig, P.S., D.P. McManus, M.W. Lightowlers, J.A. Chabalgoity, H.H. Garcia, C.M. Gavidia, R.H. Gilman, A.E. Gonzalez, M. Lorca, C. Naquira, A. Nieto and P.M. Schantz,2007. Prevention and control of Cystic Echinococcosis. Lancet infection Disease, 7: 385-394.
2. Kassai, T., 1999. Veterinary helminthology. Butterworth-Heinemann, Reed Educational and Professional Publishing Ltd. Oxford, pp: 260.
3. Budke, C., M. P. Deplazes and P. R. Togerson, 2006. Global socioeconomic impact of Cystic Echinococcosis. Emerging Infectious Disease, 12: 296-303.
4. Cringoli, G., L. Rinaldi, V. Musella, V. Veneziano, M. Maurelli, F.Di pietro, M. Frisiello and S. Di Pietro, 2007. Geo-referencing livestock farms as tool for studying Cystic Echinococcosis epidemiology in cattle and water buffaloes from southern Italy. Geospatial, 2: 105-111.
5. Schaller, K.F. and W. Kulus, 1972. Ethiopia: A geomedical monograph. *Springer*, Berlin, Heidelberg, New York.
6. Kebede, N., A. Mitiku and G. Tilahun, 2009a. Hydatidosis of slaughtered animals in Bahir Dar Abattoir, Northwestern Ethiopia. Tropical Animal Health Production, 41(1): 43-50.
7. Alemu, B., K. Nigatu, J. Tariku, T. Getachew and K. Tesfu, 2013.Occurrences and financial significance of bovine cystic echinococcosis in Southern Wollo, Northeastern Ethiopia. Journal of Veterinary Medicine and Animal Health, 5: 51-56.
8. Berssisa, K., 1994. Hydatidosis in Nekemte. Prevalence in slaughtered cattle and sheep, estimated economic loss and incidence in stray dogs. DVM Thesis, FVM, Addis Ababa univ.Debre-Zeit, Ethiopia.
9. Feyissa, R., 1987. Prevalence of hydatidosis in Nekemte municipal slaughter house. DVM Thesis, FVM, Addis Ababa univ. Debre-Zeit, Ethiopia.
10. Kebede, N., 2010. A retrospective survey of bovine hydatidosis in three abattoirs of AmharaNational Regional State, northwestern Ethiopia. Tropical Animal Health Production, 42(3): 323-325.
11. Central Statistical Agency (CSA), 2009.The Federal Democratic Republic of Ethiopia, Central Statistical Authority, Ethiopia.
12. Thrusfield, M., 1995. Veterinary Epidemiology, 2nd ed. Edinburgh, Blackwell, pp: 178-179.
13. Nicholson, M.J. and M.H. Butterworth, 1986. The Guide to Body Condition Scoring of zebu Cattle. International livestock Center for Africa, Addis Ababa, Ethiopia.
14. Dalimi, A., G. Motamedi, M. Hosseini, B. Mohammadian, H. Malaki, Z. Ghamari and F. Ghaffarifar, 2002. Echinococcosis /hydatidosis in western Iran. Veterinary Parasitology, 105: 161-171.
15. Polydorous, K., 1981. Animal health and economics case study: Echinococcosis with the reference to Cyprus. Bull Int. Epis., 93: 195-200.
16. ILCA, 1979. Trypanotolerant livestock in West and central Africa: General study. ILCA Monograph 2, Addis Ababa, Ethiopia, 1: 147.
17. Moges, E., 2003. Study on Bovine Faciolosis and Hydatidosis at Jimma abattoir. DVM Thesis, FVM, Addis Ababa univ.Debre-Zeit, Ethiopia.
18. Fikre, L., 1994. Echinococcosis/Hydatidosis in Konso (Southern Ethiopia), an assessment trial of its Prevalence, Economic and Public Health Importance. DVM Thesis, FVM, Addis Ababa univ.Debre-Zeit, Ethiopia.
19. Kebede, N., A. Abuhay, G. Tilahun and A. Wossene, 2009. Financial loss estimation, prevalence and characterization of hydatidosis of cattle slaughtered at DebreMarkosmunicipality abattoir, Ethiopia. Tropical Animal Health Production, 41: 1787-1789.

20. Azlaf, R. and A. Dakkak, 2006. Epidemiology of Cystic Echinococcosis in Morocco. Veterinary Parasitology, 131: 83-93.
21. Njoroge, E.M., P.M. Mbithi, J.M. Gathuma, T.M. Wachira, J.K. Magambo and E. Zeyhle, 2002. Study of cystic echinococcosis in slaughtered animals in three selected areas of Northern Turkana Kenya. Veterinary Parasitology, 104: 85-91.
22. Alemante, M., 2009. Study on Prevalence and Economic Significant of Hydatidosis in Cattle Slaughtered at Hawassa Abattoir. DVM Thesis, Jimma Univ. Ethiopia.
23. Woubet, M., 1987. A preliminary study onechinococcosis/hydatidosis in Harrargie region andthe efficacy of Glinus Lotoides seeds against *Echinococcus granulosus*, in pups infected experimentally with hydatid materials. DVM Thesis, FVM, Addis Ababa univ.Debre-Zeit, Ethiopia.
24. Arbabi, M. and H. Hooshyr, 2006. Survey of Echinococcosis and hydatidosis in kashanregion, central Iran. Iranian Journal of Public Health, 35(1): 75-81.
25. McManus, D.P., 2006. Molecular discrimination of Hydatid cestodes. Parasitology International, 55: 531-532.
26. Himonas, C., 1987. The Fertility of Hydatid cyst in Food Animals in Greece. Helmenth,Zoonosis, Martin, Nijohoft, Publisher, Netherland, pp: 12-18.
27. Daniel, F., 1994. Economic importance of Organs Condemnation due to Faciolosis and Hydatidosis in Cattle and Sheep Slaughtered at Dire-Dawa Abattoir. DVM Thesis, FVM, Addis Ababa univ.Debre-Zeit, Ethiopia.
28. Soulsby, E.J., 1982. Helminths/Arthropods and Protozoa of domesticated animals, 7th ed. USA, Philadelphia, Lea and Fibiger, pp: 808.
29. Urquhart, G.M., J. Armour, J.L. Duncan, A.M. Dunn and F. W. Jennings, 1996. Vet.Parasitology, 2nd edition, Black well science Ltd, UK, pp: 122-129.
30. Gemmel, M.A., M.G. Roberts, T.C. Beard, S. Campanods, J.R. Lawson and J.M. Nonnomaker, 2002. Control of echinococcosis, WHO/ OIE manual in echinococcosis in humans and Animals, pp: 53- 95.
31. Hubert, W.T., 1975. Disease Transmitted from Animal to Man, 6thed, USA, Charles Thomas Publishers, pp: 690-1206.
32. Smyth, J.D., 1985. Introduction to Animal Parasitology. London, Hodder and Stoughton, pp: 101-105.
33. Zelalem, F., 2008. Prevalence and Economic impact of Hydatidosis in Addis Ababa abattoir. DVM Thesis, Jimma Univ. Ethiopia.
34. Arene, F., 1985. Prevalence of hydatidosis in domestic livestock in the Niger Delta.Tropical Animal Health Production, 85: 69-73.
35. Nigatu, K., M. Habtamu, W. Abebe and T. Getachew, 2009. Hydatidosis of slaughtered Cattle in walaitasoddo abattoir, southern Ethiopia. Tropical Animal Health Production, 41: 629- 633.
36. Nebiyou, G., 1990. Study of hydatidosis/ Echinococcosis in cattle slaughtered at Bahir-Dar Municipal Abattoir. DVM Thesis, FVM, Addis Ababa univ. Debre-Zeit, Ethiopia.
37. Endalew, D. and I. Nuradddis, 2013. Prevalence and Economic Importance of Hydatidosis in Cattle Slaughtered at North Gonder, Elfora Abattoir. European Journal of Applied Science, 5: 29-35.