Global Veterinaria 11 (3): 329-334, 2013
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2013.11.3.2300

# Hydatidosis: Prevalence, Cyst Distribution and Economic Significance in Cattle Slaughtered at Arbaminch Municipality Abattoir, Southern Ethiopia

*Alemu Tilahun and Yitagele Terefe*

College of Veterinary Medicine, Haramaya University,
P.O. Box 281, Dire Dawa, Ethiopia

**Abstract:** A cross- sectional study was carried out from October, 2009 to April, 2010 at Arbaminch municipal abattoir with aim of determining the prevalence and cyst distribution of bovine hydatidosis and to estimate financial losses due to hydatid cyst as result of organ condemnation and carcass weight reduction. Postmortem examination, hydatid cyst characterization and direct and indirect financial loss estimations were conducted. From the total 600 cattle examined, 123(20.50 %.) were found positive for hydatid cyst infection in one or more of its organs. From 3000 samples inspected, 287 hydatid cysts were detected in 141 samples, of which 247 (86.06%) were active and the remains were calcified. The anatomical distribution of the cysts indicated as 135 (47.04%) lung, 90 (31.36%) liver, 18 (6.27%) heart, 17 (5.92%) kidney and 27 (9.41%) spleen. From the 287 cysts collected, 66 (23%), 144 (50.17%), 37 (12.89%) and 40 (13.94%) were found as small, medium, large and calcified cysts respectively. The annual economic loss from organs condemnation and carcass weight reduction was estimated about $21,833.60. This high infection in cattle with a huge financial loss justifies a hydatidosis control program that involves due attention on veterinary activities like improvement of slaughter house facilities and proper meat inspection.

**Key words:** Abattoir · Arbaminch · Cattle · Hydatidosis · Prevalence · Economic Significance

## INTRODUCTION

Hydatidosis and Echinococosis are terms often used interchangeably, to describe the zoonotic infection caused by a cestode of genus Echinococcus with species *Echinococcus granulosus* [1]. Echinococosis has a worldwide distribution; the reason is mainly due to ability of this tape worm to adapt to a wide variety of domestic and wild intermediate hosts [2]. A wide variety of animal species, both domestic and wild, that act as intermediate hosts have made *E. granulosus* to be widely distributed across the globe and at least 10 genetically distinct populations exist within the complex *E. granulosus* [1, 3].

The life cycle consists of the definitive and intermediate hosts. The definitive hosts are carnivores which harbour mature tapeworm in the intestine [4, 5] and excrete the parasite eggs along with their faeces and play a major role in the epidemiology of the disease, while livestock and humans are intermediate hosts [6,7]. The transmission of Echinococcus species from intermediate to definitive host is the result of predator-prey relationship existing between hosts, however it can be modified by human behavioral factors for synathropic cycles [1] and man is usually a dead end intermediate host [5].

The outcome of infection in humans and animals is the development of hydatid cysts in lung, liver or other organs [8]. In domestic animals disease due to hydatid cyst is rare, but in human being it is more dangerous. The significance of domestic animals as host of this parasite is therefore mainly that they act as the reservoir of the infection for man [9]. As the cysts gradually increase in size, they may impair the health status of the host and causes dyspnea when they occur in the lung or digestive disturbance and possible ascites when the liver is affected [10].

Hydatidosis occurs throughout the world and causes considerable economical and public health problems in many countries. Its distribution is usually more prevalent in developing countries especially in

**Corresponding Author:** Yitagele Terefe, College of Veterinary Medicine,
Haramaya University, P.O. Box 281, Dire Dawa, Ethiopia.
Tel: +251-911-067947, Fax: +251-025-553-0331/25.

the rural communities where the dog lives in close quarters with man and domestic herbivores, feeding on scraps and offal of wild herbivores hunted by his master or domestic herbivores bred for butchering. Previous studies have shown that cystic echinococcosis represented a considerable economic and public health significance in different countries including Ethiopia [11-18].

One of the major parasitic as well as zoonotic diseases prevailing in the area is echinococcosis/ hydatidosis occurring both in humans and in domestic animals causing huge organ loses due to condemnation. Hence knowledge on the extent of hydatidosis and associated economic loss in cattle would have paramount importance in justifying the need of an effective control scheme by considering the public health damages and economic loses. Therefore, this study is aimed at assessing the prevalence of hydatidosis, determining the cyst distribution and to estimate the direct and indirect financial losses associated with hydatidosis in cattle slaughtered at Arbaminch municipal abattoir.

## MATERIALS AND METHODS

**Study Area:** The study was conducted from October, 2009 to April, 2010 in Arbaminch town municipal abattoir, Gamo Gofa Zone, South Nation Nationality People Regional state (SNNPRS). Arbaminch is located 505 Km away from Addis Ababa in the Southern part of Ethiopia and has got an estimated population of 74,843 including 39,192 males and 35,651 females [19]. The town is located geographically at 37°5' East of longitude and 6° North of latitude with altitude ranging 1200 to 3125m above sea level. The average annual rain fall ranges from 750-930mm with mean average temperature of 30°C. The town is situated in the well known East African Rift valley and surrounded by Lake Chamo and Abaya as well as the Nech Sar National Park [20].

**Study Animals and Their Management:** The study was conducted on zebu cattle originated from districts in the vicinity of Arbaminch town such as Chano, Zigit, Ganta and Shelle as wells as from areas a little far like Wolayta, South Omo and Borana Zones. The majority (99%) of cattle that were slaughtered in the abattoir were adult male having good body condition and older than 5 years, similar to other parts of the country the cattle in these areas are managed under the traditional or extensive management system which is characterized by grazing on pasture but sometimes the owners give special intensive care for those cattle intended for fattening purpose.

**Study Design and Sample Size Determination:** A cross-sectional study was conducted to collect data associated with the prevalence and financial loss of hydatidosis in cattle slaughtered at Arbaminch municipal abattoir. The sample size was determined by 95% confidence interval at a desired accuracy level of 5% and with expected prevalence of 25.8% which is reported by previous unpublished survey conducted in the study area [21, 22]. The determined sample size was 294 cattle. However, to increase the precision of the study, a total of 600 cattle were randomly sampled and examined for the presence of hydatid cysts.

**Study Methodology**

**Meat Inspection (Postmortem Examination):** Both antemortem and postmortem examination record of slaughtered cattle was kept on specially designed sheet. The antemortem data comprises carcass identification number, origin, sex and age of cattle slaughtered in the abattoir. The age was determined based on owner's information in cooperation with dentition.

Postmortem examination was carried out on different organs of each of the slaughtered animals, particularly lung, liver, spleen, kidney, heart and the muscles. Each organ was assessed macroscopically by visual inspection and palpation and where necessary one or more incisions were made to detect small hydatid cysts [23]. The infected organs from each positive animal were collected; the total number of hydatid cysts were counted per infected organ and recorded on the sheet.

**Hydatid Cyst Distribution and Characterization:** Anatomical distribution of hydatid cyst and their status as active and calcified were determined by recording the organ affected. The diameter of collected hydatid cysts was measured and classified as small (diameter <4cm), medium (diameter between 4 and 8cm) and large (diameter >8cm) [15, 24].

**Financial Loss Assessment:** The total economic loss assessment in cattle slaughtered at the abattoir was established from direct and indirect loss incurred due to hydatidosis. Direct loss was calculated on the basis of condemned organs, whereas indirect losses were estimated on the basis of live weight reduction due to hydatidosis [25, 26].

A 5% estimated carcass weight loss due to hydatidosis, annual slaughter rates of animals, average carcass weight of 126kg for Ethiopian zebu cattle (dressing percentage) and the mean retail price of condemned organs due to hydatidosis were considered as parameter for calculating direct and indirect financial losses. Therefore, the total financial loss was the sum of direct and indirect losses.

For calculating the cost of condemned organs and carcass weight loss, ten legally registered butchers in the town were interviewed randomly to establish the local market price per unit organ. Then average price was drawn out from the data and used to calculate the loss accordingly.

Direct and indirect financial losses were roughly calculated on a yearly basis. Average local market price of lung, liver, heart, spleen, kidney and a kilogram of beef was found to be $0.4, $2.1, $0.7, $0.4, $0.9 and $3.4 respectively. The mean annual number of cattle slaughtered during the last 3 years was 4752.

**Data Management and Analysis:** Data collected from antemortem, postmortem and financial loss estimation were entered into Microsoft Excel; the statistical package STATA 7.0 version [27] was employed to analyze results.

## RESULTS

**Prevalence of Hydatidosis:** This study disclosed that from 600 local zebu cattle slaughtered at Arbaminch Municipal Abattoir and examined for the presence of hydatid cyst, 20.50% (n=123) were found harboring at least one cyst in their different organs.

Table 1: Distribution of hydatid cysts in organs of infected cattle slaughtered in Arbaminch Municipal Abattoir

| Organ infected | Number infected cattle | Percentage |
|---|---|---|
| Lung only | 59 | 48.00 |
| Liver only | 35 | 28.46 |
| Heart only | 3 | 2.44 |
| Kidney only | 8 | 6.50 |
| Spleen only | 5 | 4.06 |
| Lung and liver only | 5 | 4.06 |
| Lung and heart only | 2 | 1.63 |
| Heart and Kidney only | 1 | 0.81 |
| Liver and spleen only | 1 | 0.81 |
| Lung, liver and kidney only | 1 | 0.81 |
| Lung, liver and spleen only | 2 | 1.63 |
| Lung, Liver, Heart and spleen only | 1 | 0.81 |
| Total | 123 | 100 |

**Anatomical Distribution and Characterization of Hydatid Cyst:** The postmortem examination revealed that the distribution of hydatid cysts involved lung, liver, heart, spleen and kidney. Among 123 cattle harboring hydatid cyst, 89.43% of them had hydatid cyst infection only in a single organ whereas the remaining 10.57% occurred in more than one organ, large proportion of cattle (48%) had cysts only on their lung followed by liver (28.46%) (Table 1).

Single and multiple hydatid cyst distribution were recorded in different organs of infected cattle. The total number, relative prevalence and mean number of cysts harbored by each affected organ are shown in Table 2. Among the different organs affected, lung and liver constituted almost 82% of the overall infection of the organs.

Table 2: Distribution of hydatid cysts in different organs of infected cattle

| | | | Cyst count | | | |
|---|---|---|---|---|---|---|
| Organ affected | No. organ affected | Relative prevalence | Mean/organ | Range | Total | Percentage |
| Lung | 70 | 49.65% | 1.93 | 1-8 | 135 | 47.04 |
| Liver | 45 | 31.91% | 2 | 1-8 | 90 | 31.36 |
| Heart | 7 | 4.96% | 2.57 | 1-5 | 18 | 6.27 |
| Kidney | 10 | 7.09% | 1.70 | 1-3 | 17 | 5.92 |
| Spleen | 9 | 6.38% | 3 | 1-6 | 27 | 9.41 |
| Total | 141 | 100% | 2.04 | 1-8 | 287 | 100 |

Table 3: Characterization of hydatid cyst in the affected organs of infected cattle

| Organ affected | Small cyst | % | Medium cyst | % | Large cyst | % | Calcified cyst | % |
|---|---|---|---|---|---|---|---|---|
| Lung | 39 | 28.89 | 67 | 49.63 | 15 | 11.11 | 14 | 10.37 |
| Liver | 24 | 26.67 | 43 | 47.78 | 8 | 8.89 | 15 | 16.67 |
| Heart | - | - | 10 | 55.56 | 3 | 16.67 | 5 | 27.78 |
| Kidney | - | - | 9 | 52.94 | 2 | 11.76 | 6 | 35.29 |
| Spleen | 3 | 11.11 | 15 | 55.56 | 9 | 33.33 | - | - |
| Total | 66 | 23.00 | 144 | 50.17 | 37 | 12.89 | 40 | 13.94 |

The number of cysts found range from 1-8 in the different organs, the highest number of cysts (n=8) was observed in lung and liver. Higher proportions (73.17%) of small and medium sized cyst were found in the affected organs and among this lung and liver had the higher percentage in that order (Table 2 and 3).

**Financial Loss Assessment:** In this study the yearly based direct financial losses due to condemnation of affected organs and indirect losses due to live weight loss as a result of hydatidosis were estimated to be $967.10 and $20,866.50 respectively, which accounts to a total financial loss of $21,833.60.

## DISCUSSION

Based on the data collected in this cross-sectional study, the prevalence of bovine hydatidosis was found to be 20.50% (95% CI= 17.34%-24.00%). The current finding is comparable with the findings in Tigray region 22.1% [18], Birre-Sheleko and Dangila 15.20% [17], Gondar (24.3%) [11], Western Iran 16.4% [28], Turkey 16.6% [29], Morocco 22.98% [12] and Turkana Kenya 19.4% [30]. It was less than the previous findings of 48.7% in Ngorongoro districts of Tanzania [31], 34.05% in Bahir Dar [15], 29.69% in Ambo [32] and 25.7% in South Omo and 46.5% in Debre Zeit [11]. This may be attributed to differences in environmental conditions, livestock stocking intensity and livestock movement that contribute to the differences in prevalence rates. The variation in prevalence rate within the same species of animals could be attributed to the differences in seasonal variation, geographical locations and strain differences. Besides these, factors like difference in culture, social activity and attitude to dog in different regions might have contributed to this variation [30].

Majority (99%) of the cattle slaughtered in this abattoir were adult older than 5 years. Hence they were exposed to *E. granulosus* over a long period of time, with an increased possibility of acquiring the infection. Previous studies strongly suggested that the prevalence of bovine hydatidosis is profoundly influenced by age of the animal [33, 34].

This study shown that cysts identified are highly concentrated in lung and liver, with prevalence of 49.65% and 31.91% respectively. This finding is in agreement with the results of previous reports from different areas [11, 15, 17, 28, 35].

The higher prevalence in lung associated with the fact that cattle are slaughtered at older age. At this period the capillaries of liver are dilated and most cysts passed to the lungs. Besides this, it is possible for the hexacanth embryo to enter the lymphatic circulation and be carried via the thoracic duct to the heart and lung in such case the lung will be infected before liver. The reason for higher proportion of medium and large sized cysts in the lungs is due to its softer consistency which can accommodate expansion of cysts [9, 23].

The annual financial loss due to bovine hydatidosis in Arbaminch municipal abattoir from both direct and indirect losses was estimated to be $21,833.60, which is a significant amount of money for the country like Ethiopia, where the per capita income is less than 1 USD. This finding is higher than the report of the study conducted in some areas of the country [16, 17, 32]. The difference among the results recorded in various abattoirs may be due to the mean annual slaughter rate, variation in the retail market price of the organs and carcasses and the world financial crises that makes the currencies unstable.

In conclusion, this study disclosed that bovine hydatidosis is one of the most important diseases warranting serious consideration for its prevention and control in the area. The results will give an important clue on the public health implication of the disease in the area since there is a habit of feeding of dogs with raw visceral and free access of carnivores to the abattoir. This high infection in cattle with a huge financial loss justifies a program of hydatidosis control in the area that involves due attention on veterinary activities such as improvement of slaughter hygiene and proper meat inspection. Further studies need to be carried out in dogs and other intermediate hosts including human to make clear the cycle of transmission that could help to design appropriate controlling measures.

## ACKNOWLEDGMENTS

The authors would like to thank Haramaya University for the financial support to undertake the study. We are also grateful to Arbaminch municipality abattoir meat inspectors for their willingness to share their experience and knowledge for the successful completion of this study.

## REFERENCES

1. Thompson, R.C.A. and D.P. McManus, 2002. Aetiology: Parasites and Life Cycles. WHO/OIE Manual in Echinococcosis in humans and animals. WHO/OIE, Paris, pp: 1-19.

2. Torgerson, P., 2002. Transmission dynamics of taeniid parasites in animal hosts, pp: 221-235. In P. Craig and Z. Pawlowski (ed.), Cestode zoononoses: Echinoccosis and Cysticercosis, an emergent and global problem. IOS press. Amsterdam. The Netherlands.
3. McManus, D.P. and R.C.A. Thompson, 2003. Molecular epidemiology of cystic Echinococcosis. Parasitology, 127: S37-S40.
4. Khuroo, M.S., 2002. Hydatid disease, current status and recent advances. Ann. Saudi Med., 122: 56-64.
5. Zhang, W., J. Li and P.D. McManus, 2003. Concepts in immunology and diagnosis of hydatid disease. Am. Soc. Microbiol., 16: 18-36.
6. Seimenis, A., 2003. Overview of the epidemiological situation on Echinococcosis in the Mediterranean region. Acta Trop., 85: 191-195.
7. Okua, Y., R. Malgorb, U. Benavidezb, C. Carmonab and H. Kamiyac, 2004. Control program against Hydatidosis and the decreased prevalence in Uruguay. Int. Congr. Ser., 1267: 98-104.
8. Muller, R., 2001. Worms and Human Disease. CAB International, Oxon, UK, pp: 85-86.
9. Taylor, M.A., R.L. Coop and R.L. Wall, 2007. Veterinary Parasitology, 3rd edition, Blackwell publishing Ltd, Oxford, UK.
10. Eckert, J. and P. Delplazes, 2004. Biological, epidemiological and clinical aspects of Echinococosis, a zoonosis of increasing concern. Clin. Microbiol. Rev., 17: 107-135.
11. Jobre, Y., F. Labago, R. Tirunhe, G. Abebe and P. Dorchies, 1996. Hydatidosis in three selected regions in Ethiopia: an assessment trial on its prevalence, economic and public health importance. Rev. Med. Vet., 147: 797-804.
12. Azlaf, R. and A. Dakkak, 2006. Epidemiological study of the cystic Echinococcosis in Morocco. Veterinary Parasitology, 137: 83-93.
13. Elshazly, A.M., S.E. Awad, M.A. Hegazy, K.A. Mohammad and T.A. Morsy, 2007. *Echinococcus granulosus*/hydatidosis an endemic zoonotic disease in Egypt. Journal of the Egyptian Society of Parasitology, 37: 609-622.
14. Christodoulopoulos, G., G. Theodoropoulos and G. Petrakos, 2008. Epidemiological survey of cestode-larva disease in Greek sheep flocks. Veterinary Parasitology, 153: 368-373.
15. Kebede, N., A. Mitiku and G. Tilahun, 2008. Hydatidosis of slaughtered animals in Bahir Dar Abattoir, Northwestern Ethiopia. Trop. Anim. Health. Prod., 41: 43-50.
16. Sissay, M.M., A. Uggla and P.J. Waller, 2008. Prevalence and seasonal incidence of larval and adult cestode infections of sheep and goats in eastern Ethiopia. Trop. Anim. Health. Prod., 40: 387-394.
17. Kebede, N., Z. Gebre-Egziabher, G. Tilahun and A. Wossene, 2009 (a). Prevalence and Financial Effects of Hydatidosis in Cattle Slaughtered in Birre-Sheleko and Dangila Abattoirs, Northwestern Ethiopia. Zoonoses and Public Health, 58(1): 41-6.
18. Kebede, W., A. Hagos, Z. Girma and F. Lobago, 2009(b). Echinococcosis/hydatidosis: its prevalence, economic and public health significance in Tigray region, North Ethiopia. Trop. Anim. Health. Prod., 41: 865-871.
19. Central Statistical Authority of Ethiopia (CSA), 2007. The Federal Democratic Republic of Ethiopia, Statistical Abstract, Addis Ababa, Ethiopia.
20. Gamo Goffa Zone Agricultural and Rural Development Office (GZARDO), 2007. Livestock Resource Development and Animal Health Department Annual Report, Arbaminch, Ethiopia.
21. Mohammed, A., 1988. Study on Prevalence and Economic, Significance of Bovine Hydatidosis in Gamo Goffa region DVM thesis, Addis Ababa University Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
22. Thrusfield, M., 1995. Veterinary Epidemiology, 2nd edn. Blackwell science Ltd, Oxford, pp: 178-198.
23. Soulsby, E.J.L., 1982. Helminths, Arthropods and Protozoa of Domesticated Animals, 7th ed. Lea and Tebiger, Philadelphia, PA, pp: 119-127.
24. Oostburg, B.F.J., M.A. Vrede and A.E. Bergen, 2000. The occurrence of polycystic Echinococcosis in Suriname. Ann. Trop. Med. Parsitol., 94: 247-252.
25. Polydorou, K., 1981. Animal Health and Economics. Case study: Echinococcosis with a reference to Cyprus. Bull. Off. Int. Epizoot., 93: 981-992.
26. Torgerson, P.R., P.M. Dowling and M.N. Abo-Shehada, 2001. Estimating the economic effects of cystic echinococcosis. Part 3: Jordan, a developing country with lower-middle income. Ann. Trop. Med. Hyg., 95: 595-603.
27. STATA Corporation, 2001. Intercooled Stata Verision 7.0 for Windows 95/98/NT. University Dive East College Station, Texas, USA.
28. Hafez, A. and A. Yamen, 2002. Echinococcus/ Hydatidosis in western Iran. Veterinary Parasitology, 30: 161-171.
29. Ulutas, M., T. Estagil and E. Uzer, 2007. Prevalence of hydatidosis in slaughtered animals in Thrace, Turkey. Turk. Soc. Parasitol., 31: 41-45.

30. Njoroge, E.M., P.M. Mbithi, J.M. Gathuma, T.M. Wachira, J.K. Magambo and E. Zeyhle, 2002. A study of cystic echinococcosis in slaughter animals in three selected areas of northern Turkana, Kenya. Veterinary Parasitology, 104: 85-91.
31. Ernest, E., H.E. Nonga, A.A. Kassuku and R.R. Kazwala, 2008. Hydatidosis of slaughtered animals in Ngorongoro districts of Arusha region,Tanzania. Trop. Anim. Health. Prod.
32. Endiras, Z., T. Yechale and M. Assefa, 2010. Bovine Hydatidosis in Ambo Municipality Abattior, West Shoa, Ethiopia. Ethiopian Veterinary Journal, 14(1): 1-14.
33. Torgerson, P.R., B. Ogulzahan, A.E. Muminov, R.R. Karaeva, O.T. Kuttubaev, M. Aminzanov and B.S. Shakenov, 2005. Present situation of cystic Echinococcsis in Central Asia. Parasitology International, 55: 207-212.
34. Lahmar, S., M. Kilami and P.R. Torgerson, 2001. Frequency distributions of *Echinococcus granulosus* and other helminthes in stray dogs in Tunisia. Ann. Trop. Med. Parsitol., 95: 69-76.
35. Islam, M.K., S.C. Basaka, S. Majumder, S.A. Sarder, A.W.M.S. Islam and M.M.H. Mondal, 2003. Cystic Echinococcosis in domestic ruminants in Cox's Bazar of Bangladesh. Pak. J. Sci. Ind. Res., 46: 251-254.