Paradigm Academic Press
Journal of Innovations in Medical Research
ISSN 2788-7022
JUN. 2023 VOL.2, NO.6

Prevalence, Organ Distribution, and Economic Importance of Bovine Hydatidosis in Gimbichu Municipal Abattoir, Hadiya Zone, Ethiopia

Moges Eriso[1] & Merete Mekuriya[1]

[1] School of Veterinary Medicine, Wolaita Sodo University, Ethiopia

Correspondence: Moges Eriso, School of Veterinary Medicine, Wolaita Sodo University, Ethiopia.

doi:10.56397/JIMR/2023.06.08

Abstract

A cross-sectional study was conducted from October 2019 to July 2020 at Gimbichu municipal abattoir with the objectives of determining the prevalence of bovine hydatidosis, Organ distribution of hydatid cysts, and assessing the economic impact of the disease. Ante-mortem and postmortem examinations were performed to detect hydatid cysts. Out of 400 randomly selected cattle slaughtered at the abattoir, the prevalence of hydatidosis was found to be 83 (20.75%). The abattoir survey showed that the hydatid cyst was highest in old aged cattle (41.9%) followed by adult (17%) and young (16.5%). The analysis result showed that the hydatidosis was high in females (38%) compare with male (18.2%). Poor body condition scores were associated with higher prevalence. The lung (45.8%) and liver (40.46%) were the most commonly affected organs. The study revealed that infected organs were often contaminated with hydatid cysts from multiple sites. The findings were consistent with similar studies conducted in other regions of Ethiopia and neighboring countries. Factors such as backyard slaughtering, improper disposal of infected organs, and the presence of stray dogs contributed to the high prevalence. Recommendations include implementing strict routine meat inspection, proper disposal of infected organs, raising public awareness about the disease cycle, and treating owned dogs while avoiding contact with stray dogs. These measures are crucial to break the life cycle of *Echinococcus granulosus* and to reduce the prevalence and economic impact of bovine hydatidosis in the study area.

Keywords: abattoir, economic impact, bovine hydatidosis, organ distribution, prevalence

1. Introduction

Hydatidosis / Cystic Echinococcosis is a parasitic infection of animals and humans that is caused by the metacestod or larval stage of a small tapeworm called *Echinococusisgranulosus*. In the natural cycle of these tapeworms dog and other canids are characteristic ultimate host and ungulates as well as sheep, cattle, goat, pigs, and horses are intermediate host in which hydatid cyst occurs. Humans can develop into transitional hosts by accidentally ingesting the egg of a tapeworm. (Solusby, 1982). At present four species of Echinococcosis are recognized namely *E. granulosus, E. multilocularis*, *E. oligarchs,* and *E. vogeli*. Two hosts are engaged at the end of the existence cycle of *E. granulosus*. The ultimate hosts are carnivores which dock adult tapeworms in the intestine and expel the parasite offspring along with their faeces, while livestock and humans are the most important middle hosts (Okua*et al*., 2004).

The life cycle of *Echinococcus granulosus* involves two hosts. Definitive hosts, typically carnivores, carry mature tapeworms in their intestines and release parasite eggs through their feces. Livestock and humans serve as the main intermediate hosts (Seimenis, 2003; Okua *et al*., 2004). Dogs play a significant role in the disease's spread. They have close contact with humans and domestic herbivores, consuming scraps and offal from wild herbivores hunted by their owners or domestic herbivores raised for butchering. Infected dogs contaminate floors, houses, and villages with their excrement, leading to the ingestion of eggs by intermediate hosts. Within these hosts, metacestode stages and protoscolices develop. The cycle is completed when a suitable carnivore consumes

an intermediate host or its infected organ (Thompson & McManus, 2002). Humans, however, are typically dead-end intermediate hosts. In both humans and animals, the infection results in the formation of hydatid cysts in the lungs, liver, or other organs (Muller, 2001).

The broad range of animal species together domestic and wild, which act as transitional hosts, have made *Echinococcusgranulosus* to be commonly distributed across the globe, and at least 10 heritably different populations be present within the complex *E. granulosus* (Thompson & McManus, 2002; McManus & Thompson, 2003). CysticEchinococcusis a public health problem in different geographical areas of the world, particularly in Asia, South America, Southern America, and Africa (McManus & Smyth, 1986). Spain and other Mediterranean countries are considered hyperendemic areas of cystic *Echinococcosis* (McManus & Thompson, 2003). The eggs enter the intermediate hosts by ingestion from contaminated grass, water, vegetables, and others. It has also been shown that flies and possibly other insects may mechanically transport eggs over considerable distances having been contaminated during feeding or egg-laying activities in or on the dung. The definitive host is infected from ingestion of offals contaminated by fertile and viable hydatid cysts (Schantz, 1990).

Echinococcosis can be controlled through preventive measures that break the life cycles between the definitive host and intermediate hosts. These measures include dosing dogs, inspecting meat and educating the public on the risk to humans, and avoiding feeding offals to dogs as well as introducing legislation. None of these measures will work in isolation (WHO, 1994). Control is based on the regular treatment of dogs to eliminate adult tapeworms and prevention of infection in dogs by exclusion from their diet of animal origin containing hydatid materials. This is achieved by denying dogs access to abattoirs and where possible by proper disposal of sheep and cattle offals. In some countries, these measures have been supported by legislation with penalties when they are disregarded (Urquhart *et al*., 1987). Prevention can be achieved by instruction of farmers on patterns of transmission in endemic areas, strict personal hygiene for example washing hands after playing with or feeding dogs, and avoidance of unnecessary contact with infected dogs.

Thus, the objectives of this study were:

- ✓ To estimate the prevalence of bovine hydatidosis in cattle slaughtered at the Gimbichu municipal abattoir.
- ✓ To determine the organ distribution of hydatid cysts in infected cattle.
- ✓ To assess the economic impact of bovine hydatidosis in the study area.

2. Materials and Methods

2.1 Study Area

The study was conducted starting beginning October 2019 to July 2020 happening methodically randomly selected livestock in Gimbichu public abattoir, Southern Nations Nationalities and Peoples Region. Gimbichu is the capital of soro woreda which is located at a distance of 264 km south of Addis Ababa and it lies at an altitude of 2020 meters above sea 1evl. The mean annual temperature of the town is 20°C, and the mean annual rainfall is 900-1400 mm. Based on figures from the Southern Statistical Agency in 2005, Gimbichu has an estimated total population of 61,114 of whom 31,329 were males and 29,785 were females.

2.2 Study Population

The study animals included cattle that were brought to the abattoir from various origins and selected by systematic random selection methods. Selected cattle were inspected for the presence of cystic Echinococcosis after slaughter.

2.3 Study Design

A cross-sectional study type was employed to estimate the prevalence and organ-level distribution of cysts.

2.4 Sampling Method and Sample Size Determination

A systematic random sampling technique was followed to select the study animals. During sampling, the age, sex, origin, and body condition of the animals were recorded. Age of the study animals was estimated based on De-Lahunta and Habel (1986). Body condition for each cattle was estimated based on Nicholson and Butterworth (1986), ranging from score 1 (emaciated) to 5 (obese). The sample size for this study was calculated by using the formula given by Thrusfield (2005). To calculate the sample size, the prevalence of 50% and 95% confidence level and 5% precision were used, and accordingly, the sample size (n) was 383.

2.5 Study Methodology

2.5.1 Ante Mortem Examination

During ante mortem assessment each study animal was given detection and the age, sex, breed, origin, and body condition of the animal were recorded. The age was determined based on the dentition and owner’s information.

The body condition of the animal was categorized into poor, medium, or good.

2.5.2 Postmortem Inspection

During the abattoir, careful meat inspection was carried out on different organs of each of the slaughtered animals, particularly the lung, liver, spleen, kidney, and heart. Each organ was assessed macroscopically by visual inspection and palpation and where necessary one or more incisions were made to detect small hydatid cysts (Soulsby, 1982).

2.6 Data Management and Analysis

The data collected from the study site was stored in the format developed for this purpose and then entered into Microsoft Excel and analyzed using STATA. The effects of each risk factor on the hydatidosis occurrence were summarized by descriptive statistics and then analyzed chi-square and prevalence of they based on the different size factors.

3. Result

Out of 400 heads of cattle slaughtered and examined at the abattoir, 83 (20.75%) cattle were positive for hydatidosis. The important risk factors for the prevalence of hydatidosis are in Table 3. The high prevalence of hydatidosis is recorded in old animals. This is due to the long exposure of the cattle to the infectious eggs in their grasses which were contaminated with the feces of infected canids. The prevalence of hydatidosis is different in different body condition scores. The prevalence of cattle with poor body condition score is 3.75%; those with medium body condition score have a prevalence of 11.5% and the prevalence of cattle with good body condition score is 5.5% of the studied cattle in Gimbichu municipal abattoir.

Table 1. Prevalence of hydatidosis based on different risk factors associated with the occurrence of hydatidosis

Risk factors		**No. examined**	**No. positive**	**Prevalence (%)**
Sex	Female	50	19	4.75%
	Male	350	64	16%
Age	3-6yrs	103	17	4.25%
	7-9yrs	235	40	10%
	≥10yrs	62	26	6.5%
BSc	Poor	70	15	3.75%
	Medium	120	46	11.5%
	Good	210	22	5.5%
Origin	Gimbichu	85	21	5.25%
	Jajura	210	19	4.75%
	Jacho	105	43	10.75%
Total		400	83	20.75%

Out of the 50 females examined, 19 (4.75%) tested positive for hydatidosis. For males, out of 350 individuals examined, 64 (16%) tested positive. Among individuals aged 3-6 years, out of 103 examined, 17 (4.25%) tested positive. In the 7-9 years age group, out of 235 individuals examined, 40 (10%) tested positive. For individuals aged 10 years and above, out of 62 examined, 26 (6.5%) tested positive. These results indicate that the risk of hydatidosis increases with age, with the highest prevalence observed in the 7-9 years age group.

BSc (Socioeconomic status): The prevalence of hydatidosis also appears to be influenced by socioeconomic status. Among individuals classified as having a poor BSc, out of the 70 examined, 15 (3.75%) tested positive. In the medium BSc category, out of 120 individuals examined, 46 (11.5%) tested positive. Among individuals classified as having a good BSc, out of the 210 examined, 22 (5.5%) tested positive. These findings suggest that individuals with a higher socioeconomic status (good BSc) have a slightly higher risk of hydatidosis compared to those with a poor BSc, but the highest risk is observed in the medium BSc category.

The prevalence of hydatidosis also varies among individuals from different regions. Among individuals from the Gimbichu region, out of 85 examined, 21 tested positive, resulting in a prevalence rate of 5.25%. In the Jajura region, out of 210 individuals examined, 19 tested positive, resulting in a prevalence rate of 4.75%. Among individuals from the Jacho region, out of the 105 examined, 43 tested positive, resulting in a higher prevalence rate of 10.75%. These findings suggest that individuals from the Jacho region have the highest risk of

hydatidosis, followed by those from the Gimbichu region, while individuals from the Jajura region have the lowest risk.

The prevalence of hydatidosis based on various risk factors. It highlights that males, older age groups (particularly 7-9 years), individuals with a medium BSc, and individuals from the Jacho region are more likely to be affected by hydatidosis. These findings can help inform public health interventions and targeted prevention strategies to reduce the prevalence of hydatidosis in specific at-risk populations (Table 1).

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

Organs	No. of organs affected	Proportion (%)
Lung	60	45.8%
Liver	53	40.46%
Spleen	12	9.16%
Kidney	6	4.58%
Total	131	100

The lung was the most commonly affected organ, with 60 (45.8%), and the liver, with 53 cases, representing 40.46% of the infections. The spleen was affected in 12 (9.16%) of the cases. The kidney has the lowest number of affected organs, with only 6 (4.58%) cases positive.

These findings indicate that hydatid cysts predominantly occur in the lung and liver of infected cattle. The relatively lower involvement of the spleen and kidney suggests that these organs are less susceptible to hydatid infection compared to the lung and liver (Table 2).

Table 3. Distribution of hydatid cyst in organs of infected cattle

contaminated organs	**Quantity of infected**	**Percent contaminated**
Lung only	17	28.3%
Lung and liver only	39	67.24%
Lung, liver, and spleen only	3	5.17%
Lung and spleen only	-	-
Lung, liver, and kidney only	1	1.7%
Total	58	100%

This provides information on the distribution of hydatid cysts in various organs of infected cattle.

The percentage of contamination for all categories sums up to 100%, representing the entirety of the infected cattle slaughtered in Gimbichu abattoir (Table 3).

3.1 Economic Importance

Table 4.

Aspect	**Economic Importance**
Economic losses in the livestock industry	Hydatid cysts can lead to organ condemnation and financial losses for abattoirs and livestock farmers.
Costs of treatment and control	Preventive measures incur costs, including drugs, training, and legislation enforcement.
Trade implications	Bovine hydatidosis can impact international trade in livestock and animal products.
Public health expenditure	- Bovine hydatidosis is a zoonotic disease that causes healthcare costs, hospitalization, medication, and lost productivity.

Bovine hydatidosis in cattle slaughtered at Gimbichu municipal abattoir has economic importance in terms of losses in the livestock industry, costs of treatment and control, public health expenditure, and trade implications. Understanding the economic impact of hydatidosis can guide decision-making, resource allocation, and the development of effective strategies for disease control and prevention.

4. Discussion

The prevalence of hydatidosis in cattle recorded in the study area (20.75%) agreed with findings in Mekele (19.9%) (Kipkorir, 1998), Addis Ababa (19.7%) (Zelalem *et al*., 2012) and slightly agreed with the report of Kebede *et al*; 2009 (16%) in WolaitaSodo, Jobre *et al*; 1996 (24.3%) in Gonder and Njoroge*et al*; 2001 (19.4) in Turkana, Kenya. However, it showed variation with the findings of Tigist, 2009 (36.58%) in Jimma, Alemayehu, 1990 (54.8%) in Assela. On top of that, differences in the animal husbandry system, backyard slaughtering of animals, lack of proper disposal of infected organs, and presence of stray dogs could attribute to the variation in the prevalence of hydatidosis (Garrippa *et al*; 2004). Furthermore, differences in culture, social activities, and attitudes to dogs in different regions may contribute to variation (Macpherson et al; 1985).

The current study showed that the lungs (15%) were the most preferred predilection site for hydatid cysts followed by the liver (13.25%). This might be because cattle are slaughtered at an older age, during which period the liver capillaries are dilated and most oncospheres pass directly to the lungs.

5. Conclusion and Recommendations

The experimental dominance of bovine hydatidosis in the discovered area is comparatively higher, representing the possible risk to the person inhabitants' home in this area. Backyard slaughtering with a tendency to give condemned visceral organs to dogs, keeping untreated dogs in close association with animals and humans, and the opened abattoir for dogs and other wild canids are the major factors which favor the life cycle to continue and hence a higher infection rate in cattle. Therefore, awareness should be created in the public particularly on the risk of backyard slaughtering of food animals and offering infected offals to dogs and close association of dogs and cattle.

Based on this study and other facts about the prevalence of the disease; the following recommendations are forwarded:

- There should be strict routine meat inspection of slaughtered animals.
- Proper disposal of infected organs should be practiced to break the life cycle of Echinococcusgranulosus.
- Extension works for the public to create awareness about the cycle of the parasite. Moreover, about treatment of owned dogs and the avoidance of stray dogs.

References

Alemayehu, L, (1990). The prevalence of Hydatidosis in cattle, sheep and goat and Echinococcusgranulosus in dogs in Arsi administration region. DVM thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre-Zeit, Ethiopia.

De-Lahunta and R.E. Habel, (1986): *Teeth, applied veterinary anatomy*. W.B Saunders Company, 4-6.

Garrippa, G.A., Varicasia and A. scala, (2004). Cystic Echinococcosis in Italy from the 1950s to present. *Parasitology*, *46*, 387-391.

Jobre, Y., Lobagho, F., Tiruneh, R., Abeba, G., Dorchise, PH., (1996). Hydatidosis in three selected regions in Ethiopia: an assessment trial on its prevalence, economic and public health importance. *Revue de Medicine veterinary, 147*(11), 797-804.

Kebede, N., Abuhay, A., Tilahun, G. and Wossene, A, (2009). Financial loss estimation, Prevalence, and characterization of hydatidosis of cattle slaughtered at Debre Markos Municipal abattoir, Ethiopia. *Tropical Animal Health and Production*, *41*, 1787-1789.

Macpherson, N.L., Zeyhle, E. and Roving, T, (1985). An Echinococcosis pilot control program for North West Turkana, Kenya. *Annals of Tropical Medicine and Parasitology, 78*, 188-192.

McManus, D. P. and Smyth, J. D, (1986). Hydatidosis: Changing concepts in Epidemiology and speciation. *Parasitol. Today, 2*, 163-168.

Muller, R, (2001). Worms and Human Disease. *CAB* International, Oxon, UK, 85-86.

Nicholson M.J., Butterworth M.H., (1986): A guide condition scoring of Zebu cattle international livestock center for Africa, Addis Ababa, Ethiopia.

Okua, Y. R., Malgorb, U., Benavidezb, C., Carmona, C. and H. Kamiyac, (2004). Control Program against

hydatidosis and the decreased prevalence in Uruguay. *Int. Congr. Ser, 1267*, 98-104.

Schantz, P.M. and Gottstein, B, (1990). *Echinococcosis / Hydatidosis, Immunodiagnosis of Parasitic Disease*, Academic Press, and Orlando, FL, 69-107.

Seimenis, A, (2003). Overview of the epidemiological situation on Echinococcosis in the Mediterranean region. *Acta Trop*, *85*, 191-195.

Soulsby, E.J.L., (1982). *Helminths, Arthropods, and protozoa of Domesticated Animals*, 7th ed. Lea and Tebiger, Philadelphia, PA, 119-127.

Thompson, R. C. A., and McManus, D.P., (2002). An etiology: Parasites and Life Cycles. WHO/OIE manual in Echinococcosis in humans and animals. WHO/OIE, Paris, 1-19.

Tigist, N., (2009). Prevalence and economic importance of bovine hydatidosis in Bahir-Dar municipal abattoir. DVM thesis, School of Veterinary Medicine, Jimma University, Jimma, Ethiopia.

Urquhart, G.M., Armour, J., Duncan, J.L., Dunn, A.M., Jennings, F.W., (1996). *Veterinary Parasitology*. 2nd edition, London, Blackwell Science.

WHO, (1994). Guidelines for surveillance, prevention, and control of taeniasis/ cysticercosis. In: Gemmell, M., Matyas, Z., Pawlowski, Z., Soulsby, E.J.L., 83(49), 207.

Zelalem, F., Tadele, T., Zelalem, N., Chanda, M., Nigatu, K., (2012). Prevalence and characterization of hydatidosis in animals slaughtered at Addis Ababa abattoir, Ethiopia.

Appendix

Annex 1. Body condition score of the cattle

During the study period, the body conditions are classified into poor, medium, and good using the body condition scoring method according to Morgan *et al*. (2006).

Score 1	The individual Spinous process is sharp when touched and easily distinguished.
Score 2	The Spinous process can be identified individually when touched but feel round rather than sharp.
Score 3	The Spinous process can only be felt with very firm pressure and the area on either side of the tail head has some fat cover.
Score 4	Fat cover around the tail head is easily seen as slightly smooth, and soft to the touch; the Spinous process cannot be felt.
Score 5	The bone structure of the animal is no longer noticeable and the tail head is almost completely buried in fatty tissue.

- **Poor**-Body condition score 1 and 2
- **Medium**-Body condition score 3 and 4
- **Good**-Body condition score 5

Annex 2. Data collecting format

No	Address	Sex	Age	Body condition	Examined organs				Result (+ve/-ve)
					Liver	Lung	heart	spleen	