International Journal of Livestock Research, Vol. 11 (12) Dec' 2021
http://www.ijlr.org
eISSN: 2277-1964

Review Article

Prevalence, Associated Risk Factors and Cyst Distribution of Hydatidosis in Cattle Slaughtered at Nekemte Municipal Abattoir, Western Ethiopia

Mergo Yonas Shuramo[1], Kirubel Paulos Gutama[2], Mati Roba Bulcha[3] and Mahendra Pal[4]*

[1]Degem Woreda Livestock and Fishery Development and Resource Office, North Shoa Zone, Oromia, ETHIOPIA
[2]Adaba District Livestock and Fishery Development and Resource Office, Oromia, West Arsi Zone, ETHIOPIA
[3]Yemalog Walal Woreda Livestock and Fishery Development and Resource Office, Kellem Wollega Zone, Oromia, ETHIOPIA
[4]Narayan Consultancy on Veterinary Public Health and Microbiology, Anand, INDIA

*Corresponding Author: palmahendra2@gmail.com

How to cite this paper: Shuramo, M., Gutama, K., Bulcha, M., & Pal, M. (2021). Prevalence, Associated Risk Factors and Cyst Distribution of Hydatidosis in Cattle Slaughtered at Nekemte Municipal Abattoir, Western Ethiopia. *International Journal of Livestock Research*, 11(12), 18-23. https://dx.doi.org/10.5455/ijlr.20210826051703

Received : Aug 26, 2021
Accepted : Dec 29, 2021
Published : Dec 31, 2021

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Abstract

A cross-sectional study was conducted from December, 2014 to April, 2015 to estimate the prevalence of hydatid cyst, investigate associated risk factors, and evaluate organ level distribution of the cysts in cattle slaughtered at Nekemte Municipal abattoir, Western Ethiopia. A total of 525 samples were collected and processed. The study animals were selected by systematic random sampling technique. Potential risk factors were assessed through antemortem examination. Postmortem examination was done, which included primary examination (visual inspection and palpation of lung, liver, heart, spleen and kidney) and secondary examination, which involved further incision into each organ if single or more hydatid cyst(s) was found. Descriptive statistics were used to summarize the prevalence of bovine hydatidosis and Chi-square (X2) test was applied to compare the infection status with regard to the hypothesized risk factors and (P<0.05) was set for statistical significance. The overall prevalence of hydatid cyst was 18.29 % (95%:14.97-21.60). Out of the 96-cattle harboring hydatid cyst, 63 (65.6%) animals were infected only in single organ whereas the remaining 33 (34.4%) infected animals had multiple organs involvement. From the total 96 hydatid cyst infected cattle, 34 (35.4%) of hydatid cyst were in the lungs, 29 (30.2%) in livers and 33 (34.4%) in multiple organs. The statistical analysis revealed that there was no statistical association (P>0.05) between the prevalence of bovine hydatidosis and animal sex or body condition, although there was a significant association (P<0.05) with age and origin of the animals. In conclusion, the disease is widespread in cattle slaughtered and is major cause of organ condemnation at Nekemte Municipal abattoir and efficient meat inspection service and safe disposal of condemned organs should be practiced.

Keywords: Abattoir, Cyst Distribution, Hydatidosis, Nekemte, Prevalence

Introduction

The disease induced by the zoonotic tapeworm *Echinococcus granulosus* is known as hydatid disease (Pal, 2007). Hydatidosis is one of the most common parasitic infections that contribute to decreased meat production output owing to the carcass or organ condemnation (Abebe and Jobre, 2011). It is considered as one of the world's leading zoonosis, affecting both people and domestic animals (Cringoli *et al*., 2007; Pal *et al*., 2020). Dogs are the definitive hosts of the parasite, *Echinococcus granulosus*, which carry adult tape worms and excrete parasite eggs in their feces, while livestock and humans are the main intermediate hosts (Oku *et al*., 2004), with hydatid cysts developing in the lungs, liver, and other organs as a result of infection (Muller, 2001; Budke *et al.*, 2006). Domestic animals' importance as parasite hosts is mostly due to the fact that they serve as a reservoir for the infection in humans (Taylor *et al*., 2007). As the cysts grow in size, they might compromise the host's health, causing dyspnea if they develop in the lungs, digestive disturbances, and may be ascites if the liver is involved (Eckert and Delplazes, 2004). The incidence of human hydatidosis and the prevalence of the hydatidosis in domestic animals are the highest in countries where there is a large dog population (Khuroo, 2002). In Ethiopia, 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 (Kebede *et al*., 2009). The problem associated with tapeworm is more serious in Ethiopia because of the common habits of consuming under cooked meat (Kebede, 2010).

Several studies have reported the prevalence of bovine hydatidosis in abattoirs of Ethiopia (Berhe, 2009; Kebede *et al*., 2009; Pal *et al*., 2020). Despite the foregoing studies, the disease has not been well investigated, and information on its prevalence and associated risk factors is still inadequate, particularly in and around Nekemte. Furthermore, having sufficient information regarding the disease's prevalence and related risk factors in the research area is critical for developing an appropriate preventative and control approach. Therefore, the objectives of this study are to estimate the prevalence, investigate potential risk factors and cyst distribution of hydatidosis in cattle slaughtered at Nekemte municipal abattoir, Western Ethiopia.

Materials and Methods

Study Area Description

The study was conducted in Nekemte town, East Wollega Zone of Oromia regional state, Western Ethiopia. Nekemte is 328 km away far from Addis Ababa. It is located between a latitude and longitude of $9^0$5'N$36^0$33'E and has elevation of 2088 meter above sea level. The area receives the average annual rainfall of 1850mm. The mean monthly minimum and maximum temperature were 10.5 and 31^0c respectively. The livestock population of the area comprises of 925, 144 cattle, 220, 875 sheep, 146, 775 goats, 92,250 equines, 794, 484 head of chickens and 176,532 bee hives. Nekemte Municipal Abattoir is located at Bake Jama kebele on the main road of Nekemte-Gimbi. In this abattoir, on an average 30 cattle were slaughtered every day (NTAO, 2013).

Study Animals

The study animals were cattle of both sexes brought to the Nekemte abattoir for slaughter. These animals were bought from different market places found in and around Nekemte, such as Arjo, Arjo-Gudatu, Bandira, Bedele, Diga, Getama, Nekemte, Sorga, Uke and Wayutuka.

Study Design

A cross-sectional study was conducted from December, 2014 to April, 2015 to estimate the prevalence, investigate potential risk factors and cyst distribution of bovine hydatidosis in Nekemte municipal abattoir.

Sample Size Determination and Sampling Method

The total number of cattle required for the study was calculated by using the formula suggested by Thrusfield, (2007). In this study, 23.17% expected prevalence is taken (Abuna *et al.*, 2011), to determine samples size with 95% confidence interval (CI) and 5% desired absolute precision.

$$n = \frac{1.96^2 p(1-p)}{d^2}$$

Where,

n = sample size of the study population
d = desired precision
p = 50% expected prevalence

Accordingly, based on the above formula a sample size of 274 was calculated, but to increase the level of precision sample size had been increased to 525. Systematic random sampling technique was employed in the lairage to select study animals by using 5 sampling interval.

Active Abattoir Survey

Ante mortem Examination

In the study, animals were selected by systematic random sampling on the basis of the entrance of animals into lairage. The age, sex, body condition and the origin of each individual animal was identified and recorded. Animals were classified as poor, medium, or good based on their body condition (Nicolson and Butterworth, 1986). Dentitions were used to estimate the age of the animal based on the criteria of De lahunta and Habel, (1986), and all animals were divided into three groups: 4-6 years, 6-8 years, and greater than 8 years.

Post-mortem Examination

During postmortem inspection, carcass and predilection site of the suspected parasites were thoroughly inspected according to Meat Inspection Regulation by Government of Ethiopia (MoA, 1972). The inspection procedure used during the postmortem examination consisted of two steps, namely primary and secondary examinations. Primary examination involved visual inspection and palpation of visceral organs (lung, liver, heart, spleen and kidney), followed by a secondary examination if evidence of metacestode was found. The secondary examination involved further incision into each organ if single or more hydatid cyst (s) was found. The total number of cysts and their size obtained per organ, and the number and type of the organ condemned was also recorded.

Data Management and Analysis

All collected data was entered into a computer using Microsoft Excel and transferred to STATA version 11.0 (Stata Corp. College Station, TX, USA) for analysis. Descriptive statics was carried out to summarize prevalence of hydatid cyst, the proportion of the positive organs and anatomical distribution of the cysts in each organ. Chi-square (X^2) test was applied to compare the infection status with regard to the hypothesized risk factors and ($P<0.05$) was set for statistical significance.

Results and Discussion

Prevalence and Associated Risk Factors

Out of 525 animals examined at abattoir, the overall prevalence of hydatidosis was 18.29% (95%:14.97-21.60). The occurrence of bovine hydatidosis was not statistically significantly associated with sex and body condition score of the animals ($P>0.05$), however, statistically significantly associated with age and origin the animals ($P<0.05$) (Table 1).

Table 1: Hydatid cyst occurrence with various potential risk factors

Risk factor	No. of animals examined	No. of infected animals	X2	P-Value
Sex				
Male	475	89(18.74)	0.68	0.41
Female	50	7(14)		
Age				
4-6 years	32	5(15.63)	7.69	0.02
6-8 years	360	56(15.56)		
>8 years	133	35(26.32)		
Body condition				
Poor	26	7(26.92)	3	0.22
Medium	348	57(16.38)		
Good	151	32(21.19)		
Origin				
Arjo	26	5(19.23)	28.64	0
Arjo-Gudatu	39	6(15.38)		
Bandira	162	50(30.86)		
Bedele	11	1(9.09)		
Diga	73	7(9.59)		
Getema	73	10(13.70)		
Nekemte	11	3(27.27)		
Sorga	9	1(11.11)		
Uke	59	5(8.47)		
Wayutuka	62	8(12.90)		

Proportion of Organ Affected

Both single and multiple infected organs are recorded. Out of the 96 cattle harboring hydatid cysts, 63 (65.6%) animals were infected only in single organ whereas the remaining 33 (34.4%) infected animals had multiple organs involvement. From a total hydatid cyst infected cattle (96), 34 (35.4%) of hydatid cyst were found in the lungs, 29 (30.2%) in livers and 33 (34.4%) in multiple organs (Table 2).

Table 2: Distribution of hydatid cyst on different organs

Infected organ	No. of infected animals	Relative percentage (%)
Lung	34	35.4
Liver	29	30.2
Liver and lung	27	28.2
Liver, lung and heart	3	3.1
Liver, lung and spleen	2	2.1
Liver and spleen	1	1
Total	96	100

The prevalence of hydatid cyst in this study was 18.29% (96/525), which is in agreement with the findings of Bizuwork and co-investigators, (2013) at South Wollo (17%) and Assefa and Tesfay, (2012) at Adigrat (18.6%). However, the prevalence of this study was lower than the findings of Kipkorir, (1998) in Assela (60.8%) and Jobire and co-workers, (1996) in cattle slaughtered at Debre Zeit (46.5%) and higher than the prevalence of 11.26% in Mizan Teppi (Jemere *et al.*, 2013). The differences in hydatidosis prevalence among cattle in different areas of Ethiopia could be due to a range of factors, including agro-ecology, public awareness, society's culture and religion.

The prevalence of hydatidosis was statistically not significant with the sex and body condition of the animal. But the higher prevalence of disease was found to be on poor body condition. With regards to rate of infection of hydatidosis in age groups and origin of cattle, significant difference ($P<0.005$) was observed. Animals over 8 years of age were highly affected. Our observation is similar to the finding of Umur, (2003), Azlaf and Dakkak, (2006) and Esatgil and Tuzer, (2007). The difference in infection rate could be mainly due to longer exposure time to *Echinococcus granulosus*.

The liver and lung were the most commonly infected organs. This might be due to the fact that cattle were slaughtered at older age, during which period the liver capillaries are dilated and most oncospheres pass directly to the lung. The kidney and spleen were the least affected organs in the study animals. Similar findings were also obtained by Tolosa *et al.* (2009) at Jimma municipal and Zewdu *et al.* (2010) at Ambo municipality abattoir. The liver and lungs are the most commonly affected organs with hydatid cyst due to the reason that there are the large capillary fields encountered by the blood borne onchospheres. However, the development of hydatid cysts occurs occasionally in other organs and tissue when onchosphere escape in to the general systemic circulation (Hailemariam, 1996).

Conclusion and Recommendations

Hydatidosis is a widespread parasitic disease in slaughtered cattle, according to this finding, and is the leading cause of organ condemnation at the Nekemte municipal abattoir. The lung and liver showed the largest cyst distribution as compared to other organs, which could contribute to a higher rate of condemnation for these organs. Hydatidosis appears to be an economically important disease in the study area, owing to the disease's increased incidence in cattle and the resulting financial losses. Hence, efficient meat inspection service, periodic deworming of dogs and safe disposal of condemned organs, educating the public about hydatidosis and detailed epidemiological investigations of hydatid cyst are recommended.

Acknowledgements

The authors are very thankful to Prof. Dr. R.K. Narayan for his suggestions during the preparation of manuscript and Anubha Priyabandhu for computer help. This paper is dedicated to the scientists who made important contribution in the field of parasitic zoonoses.

Contribution of Authors

All the authors contributed equally. They read the final version, and approved it for the publication.

Conflict of Interests

There is no conflict of interest.

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