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Research Article

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Hydatid cyst prevalence in cattle slaughtered at Bedele town municipal Abattoir, South Western Ethiopia

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Abstract

A cross-sectional study was conducted from January to April 2022 to estimate the prevalence of hydatid cysts with associated risk factors and to identify the organ level distribution of cysts in the body organs of slaughtered cattle at Bedele Municipal Abattoir, southwestern Ethiopia. A total of 150 samples were collected and processed. The study animals were selected by a systematic random sampling technique. Antemortem and postmortem examinations were performed, which included antemortem identification, such as sex, age, body condition and origin, postmortem 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) were found. Descriptive statistics were used to summarize the prevalence and distribution of bovine hydatidosis. The overall prevalence of hydatid cysts was 18%. Out of the 27 cattle harboring hydatid cysts, 18 (66.7%) animals were infected only in a single organ, whereas the remaining 9 (33.3%) infected animals had multiple organ involvement. Of the 27 hydatid cyst-infected cattle, 13 (48.1%) hydatid cysts were in the lungs, 4 (14.8%) were in the liver, 1 (3.7%) was in the spleen and 9 (33.3%) were in multiple organs. In conclusion, the disease is widespread in slaughtered cattle and is a major cause of organ condemnation at the Bedele Municipal abattoir, and efficient meat inspection service and safe disposal of condemned organs should be practiced.

Keywords: Abattoir, Bedele, Cyst Distribution, Hydatidosis, 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 carcass or organ condemnation (Abebe and Jobre, 2011). It is considered one of the world's leading zoonoses, affecting both people and domestic animals (Cringoli et al., 2007; Pal et al., 2020). Dogs and other canids are definitive hosts for the parasite, while livestock are intermediate hosts. Man is an aberrant intermediate host. The outcome of infection in livestock and man is hydatid cyst development in lung, liver or other organs.

Hydatid disease has been known as a clinical entity since ancient times. Its parasitic nature was recognized as early as 1684 by Redi, Harmann and others. Goeze in 1782 pointed out that the scolices were of teanial origin and differentiated the hydatid cyst from cysticercus and the coenurus. The adult worm was observed in the intestine of dogs in 1808 by Rudolphi, but it was not until 1850 that it was recognized by Van benden as a distinct species that he later named Taenia nana. In 1852, Von Siebold recovered the adult worm from dogs that had eaten echinococcal cysts of cattle (Belding, 2005).

Definitive hosts of E. *granulosus* are domestic dogs and some wild canids. Adult cestodes live attached deep inside mucosal crypts of definitive hosts small intestine of dogs. The parasite is 3 to 6 mm long. It has 22 large hooks and 18 small hooks on scolex and usually has three proglottids, of which only the last is gravid (Acha and Szyfres, 2001). The gravid proglottid contains several hundred eggs, and detaches from the strobila are expelled with feces and distinguish in the environment. Each egg contains an embryo (oncophere) with six hooks (hexacanth), which is infective when ingested by an intermediate host and continues to develop. Intermediate hosts are sheep, goats,bovines, swine, equines, camelids, canids and humans. The most common localization of these cysts in the intermediate hosts are the liver (in about two-thirds of the cases) and the lungs (in about fourth of the cases). On rare occasions, they may become situated in some other organs, such as the kidneys, spleen, bones and brain (Eddi et al., 2004).

Hydatid cysts cause severe disease and death in humans and result in economic loss for treatment costs, lost wages and livestock annual production loss (Budke et al., 2006). The fertility of hydatid cysts occurring in various intermediate host species is one of the most important factors in the epidemiology of the disease (Himonas et al., 1994). The fertility of hydatid cysts varies depending on intermediate host species and geographical areas (Saeed et al., 2000).

Domestic animals' importance as parasite hosts is mostly because they serve as a reservoir for 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 ascites if the liver is involved (Eckert and Delplazes, 2004).
The incidence of human hydatidosis and the prevalence of 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 a 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 cooked meat (Kebede, 2010).

In Ethiopia, very few studies have been conducted on hydatidosis, and the prevalence rates changed between 13.7 and 72.44% in cattle and 9.9 and 35% in sheep in the Assela, Nazareth, Gondar, Bahir Dar and Dire Dawa abattoirs, respectively (Jobre et al., 1996; Kebede et al., 2009).

Statement of the Problem

Several studies have reported the prevalence of bovine hydatidosis in abattoirs in Ethiopia (Berhe, 2009; Kebede et al., 2009; Jenberie et al., 2011; Fikire et al., 2012; Gebeyehu and Gondar, 2015; Pal et al., 2020; Shuramo et al., 2021; Jilo et al., 2022). Despite the foregoing studies, the disease has not been well investigated, and information on its prevalence is still inadequate, particularly in and around Bedele. Furthermore, having sufficient information regarding the disease's prevalence in the research area is critical for developing an appropriate preventative and control approach. Therefore, the objectives of this study were to assess the prevalence and cyst distribution of hydatidosis in cattle slaughtered at Bedele municipal abattoir, southwestern Ethiopia.

Objective of the Study

- To estimate the prevalence rate of hydatid cysts with associated risk factors
- To identify the distribution of hydatid cysts in the body organs of slaughtered animals

Significance of the Study

There are very few known scholarly studies conducted on the prevalence of hydatid cysts in the current study area. Therefore, this study has many contributions. First, estimating the prevalence of hydatid cysts in bovines helps abattoir workers and concerned bodies make decisions on meat handling. Second, it widens information to the community, government officials and animal health veterinarians to take appropriate mechanisms to control, prevent and treat the disease.

Study Scope

The study was delimited to the prevalence of hydatid cysts in cattle slaughtered at the Bedele municipal abattoir from January to April 2022. It was focused on the prevalence of hydatidosis with associated risk factors such as sex, age, body condition and origin and distribution/occurrence of cysts in body organs of slaughtered animals.

Materials and Methods

Description of the Study Area

The research was carried out in Bedele, BunoBedele Zone, Oromia regional state, southern Ethiopia. Bedele is 480 kilometers from Addis Abeba. It is located between latitudes 8026'00" and 8028'30" north, and longitudes 36019'20" and 36022'00" east, with an elevation of 2010 meters above sea level (Appendix 5). The yearly rainfall in the region ranges from 1350 to 1850 mm. The average monthly minimum and maximum temperatures were 14 and 26 degrees Celsius, respectively. The area's livestock population includes 112,205 head of cattle, 31,302 head of sheep, 26,864 head of goats, 9,521 horse, and 62,550 head of poultry. Every day, 35 animals were murdered at this slaughterhouse (BTAO, 2021)

Study Design

A cross-sectional study was conducted from January to April 2022 to determine the prevalence and distribution of cysts in cattle slaughtered at the Bedele municipal abattoir.

Study population/animal

The study animals were cattle of both sexes brought to the Bedele abattoir for slaughter. These animals were bought from different districts around Bedele town.

Sample Size 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, 17.6% expected prevalence was taken (Mesay et al., 2017) to determine the sample size with a 95% confidence interval (CI) and 5% desired absolute precision. Accordingly, based on the above formula, the sample size would be 223. However, due to the limited time and budget the researcher has faced, only a sample size of 150 was taken for the study. A systematic random sampling technique was employed in the laboratory to select these animals (150).

$N=\frac{1.96^2\ p(1-p)}{d^2}$= 150 wheren = sample size of the study pulation and d = desired precision, p = 17.6% expected prevalence

Data Collection Method

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 origin of each individual animal were 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 animals based on the criteria of De lahunta and Habel (1986), and all animals were divided into two age groups: young (≤ 5 years) and old (greater than 5 years).

Postmortem Examination

During postmortem inspection, carcass and predilection sites of the suspected parasites were thoroughly inspected according to Meat Inspection Regulation by the 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 metacestodes was found. The secondary examination involved a further incision into each organ if single or more hydatid cyst(s) were found. The total number of cysts obtained per organ and the number and type of organs condemned were also recorded.

Data Analysis Method

All collected data were entered into a computer using Microsoft Excel for analysis. Descriptive statistics were carried out to summarize the prevalence of hydatid cysts, the proportion of positive organs and the anatomical distribution of cysts in each organ.

Results and Discussion

This investigation was done at a municipal slaughterhouse in Bedele, and 150 animals were examined. 27 (18%) of the animals developed single or multiple hydratid cysts. Postmortem test results revealed that hydatid cysts had infiltrated several organs. There have been reports of single and multiple organ infections. The disease's prevalence in cattle was assessed using risk variables (age, sex, origin and body condition of the examined animals).

The incidence of hydatid cysts in cattle was investigated in two sexes and age groups. The prevalence of hydatid cysts in men and females was 19 (18.6%) and 8 (16.7%), respectively, and 1 (8.3%) and 26 (18.8%) in the juvenile and adult age groups, respectively (Table 3).

Table 3: Prevalence of hydatidosis based on sex and age (N = 150)

Risk factor	Categories	Animals examined	Infected animals	Percentage
Sex	Male	102	19	18.6
	Female	48	8	16.7
Age	Young (≤ 5 years)	12	1	8.3
	Old (> 5 years)	138	26	18.8
Body condition	Poor	18	7	22.2
	Medium	46	8	17.4
	Good	86	12	16.3
Origin	Chewaka/Abdela	59	10	17
	Gechi	46	7	15.2
	Didesa	45	10	22.2
Body condition	Poor	18	7	22.2
	Medium	46	8	17.4
	Good	86	12	16.3
Total		**150**	**27**	**18**

With respect to the body condition of cattle, the highest prevalence of 7 (39%) was recorded in cattle with poor body condition, followed by medium 8 (17.4%) and good body condition scores 20 (9.7%). Similarly, the highest prevalence was recorded in cattle from Didessa 10 (22.2%), followed by cattle from Chewaka 10 (17%) and cattle from Gechi scores 7 (15.2%) (Table 4).In this study, the prevalence of hydatid cysts in slaughtered cattle was 18% (27 out of 150), which is similar to the findings of several authors: Assefa and Tesfay (2012) at Adigrat (18.6%), Fikire et al. (2012) at Addis Ababa (19.7%), Bizuwork and coinvestigators (2013) at South Wollo (17%), and Shuramo et al. (2021) at Nekemt However, the prevalence of this study was lower than that of Kipkorir (1998) in Assela (60.8%), Jobire and coworkers (1996) in cattle slaughtered at DebreZeit (46.5%), Terefe et al. (2012) in Addis Ababa (40.5%), and Gebeyehu and Gondar (2015) in DebireBirhan (26.8%), but higher than that of MizanTeppi (11.26%). (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.

There is evidence of a single infected organ as well as several diseased organs. 18 (66.7%) of the 27 calves afflicted with hydatid cysts were only infected in one organ, whereas the remaining 9 (33.3%) were infected in several organs. Thirteen (48.1%) of 27 infected calves with hydatidcysts were found in the lungs, four (14.8%) in the liver, one (3.7%) in the spleen, and nine (33.3%) in other organs (Table 5).

Table 5: Distribution of hydatid cysts in different visceral organs of positive (N = 27)

Infected organ/s	No.of animal affected	% affected
Lung only	13	48.1
Liver only	4	14.8
Spleen only	1	3.7
Lung and Liver	5	18.5
Lung and kidney	1	3.7
Lung and Spleen	2	7.4
Lung + liver + spleen + kidney	1	3.7
Total	**27**	**100**

The most usually affected organs were the lungs and liver. This might be due to calves being slaughtered at a later age, when the liver capillaries are dilated and most oncospheres flow directly to the lung. In the research animals, the kidney and heart were the least impacted organs. Tolosa et al. (2009) discovered similar results at the Jimma municipal slaughterhouse and Zewdu et al. (2010) discovered similar results at the Ambo municipal abattoir. Because blood-borne oncospheres face vast capillary fields, the liver and lungs are the most typically afflicted organs with hydatid cysts. However, hydatid cysts can form in various organs and tissues when the onchosphere escapes into the general systemic circulation (Hailemariam, 1996).

Conclusion and Recommendations

The study area is believed to have a high prevalence of hydatidosis. As a result, bovine hydatidosis is a significant parasitic disease with economic and public health implications. Factors such as the existence of more stray dogs who frequent the slaughterhouse grounds and feast on condemned organs, as well as a lack of public awareness about hydatidosis and backyard slaughtering, all contribute to disease spread in the region. Based on the findings of the current study and the reality in the Bedele municipal slaughterhouse and its surrounds, the following key efforts are recommended to decrease the disease's prevalence and distribution:

- ✓ Since it's necessary to implement control programs for the free disposal of afflicted visceral organs in dogs, wild canids should be halted, and all condemned organs should be buried or cremated.
- ✓ Slaughterhouses and abattoirs should be enclosed to prevent harmful host animal contact with condemned internal parts and carcasses (dogs, hyenas, and others).
- ✓ Public awareness of the involvement of dogs in the transmission of Echinoccosis in animals should be increased.
- ✓ Slaughtering techniques outside abattoirs should be regulated by implementing meat hygiene laws and regulations.
- ✓ Dogs should be tested and dewormed as usual across the country.
- ✓ To establish a clear information system on hydatidosis, advanced research on the disease's epidemiology and economic relevance should be conducted.

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APPENDIX

Appendix 1: Description of body condition score

Scores	Condition	Features
1	P-	Marked emaciation (animal could condemned at ante mortem examination)
2	P	Transverse process project prominently, neural spines appear sharply.
3	P+	Individual dorsal spins are pointed to the touch, hips, pins, tail head and ribs are prominent. Transverse process visible, usually individually
4	M-	Ribs, hips and spines clearly visible muscle mass between hook of spines slightly concave and slightly more flesh above the transverse process
5	M	Ribs usually visible little fat cover dorsal spines barely visible.
6	M+	All smooth and well covered, dorsal spine cannot be seen, but are easily left
7	G-	All smooth and well covered, but fat deposits are not marked, dorsal spines can be felt with firm pressure but rounded rather than sharpe
8	G	Fat cover in critical areas can be easily seen and felt, transverse process cannot be seen
9	G+	Heavy deposit of fat clearly visible on tail, head, brisket and cad, dorsal spine, ribs, hook and spines fully covered and cannot be felt even with firm pressure

Source: Nicholson and Butterworth (1986).

Note: body condition scores:

- 1, 2, and 3 are poor body condition
- 4, 5, and 6 are medium body condition
- 7, 8 and 9 are good body condition

Appendix 2: Age determination based on dental formula

Age (year)	Characteristic change
1 ½-2	I1 erupts
2-2 ½	I2 erupts
3	I3 erupts
3 ½ -4	I4 erupts
5	all incisor and canine are in wear
6	I1 is level and the neck has emerged from the gum
7	I2 is level and the neck is visible
8	I3 is level and the neck is visible I4 may be level
9	I4 is level and the neck is visible
10	The dental stare is square in I2 and in all teeth by 12 years
15	The teeth that are not fallen out are reduced small round.

Source: De-Luata and Habel (1986)

Note: The canine of ruminants is usually considered the fourth incisor.

Appendix 3: Data Collection Format for Antemortem Examination

Code	Sex	Age		Body condition			Origin
		Young	Old	Poor	Medium	Good	

Remarks: Young = Age ≤ 5 years; Old = Age greater than 5 years Appendix 4: Data Collection Format for

Postmortem Examination

Code	Infected Organ				
	Lung	Liver	Heart	Spleen	Kidney

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