



Prevalence of Hydatidosis and its Financial Losses in Cattle Slaughtered at Fedis District, Eastern Hararghe, Oromia, Ethiopia

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Abstract

Background: Hydatidosis is a parasitic zoonotic disease that causes risk to public health and economic losses due to organ condemnation and carcass weight reduction in developing countries.

Methods: The cross-sectional study was conducted from November 2020 to June 2021 in Fedis District Boko slaughterhouse from to determine the prevalence and annual economic losses due to bovine hydatidosis.

Results: A total of 154 examined cattle via standard meat inspection procedures, the overall prevalence of bovine hydatidosis was 27 (17.5%). In this finding the prevalence of bovine hydatidosis was higher in animals with 33% in old than 8.2% in adult age groups. In the present study, the highest prevalence of 55% was recorded in animals with poor body conditions in medium and good. In this finding, statistically significant ($p < 0.05$) associations were observed between age groups and body conditions. The distribution of cysts per organ was significantly higher in lung 26 (43.2%) than in the rest of the organs examined. The total annual financial loss due to bovine hydatidosis in Fedis District was estimated to be 899, 430 ETB.

Conclusion and Recommendations: The present finding showed that bovine hydatidosis had huge Socio-economic impacts in the study area. Therefore, appropriate control and prevention measures such as community awareness on stray dog control and implementation of proper meat inspection procedures are recommended to reduce the incidence of the disease and to minimize the socio economic impacts of bovine hydatidosis.

Keywords: Bovine Hydatidosis; Fedis; Prevalence; Risk Factors; Slaughterhouse

Introduction

Ethiopia has the largest animal population in Africa, but the contribution from these huge livestock resources to the national income is disproportionately small, due to several factors. Among them, parasitic diseases are considered as a major problem in the health and product performance of livestock. Hydatidosis is one of the most important parasitic diseases, which affects the efficiency of both animals and Human beings. There are four forms of diseases, known as cystic, alveolar, polycystic and unicystic echinococcosis caused by infection with *E. granulosus*, *E. multilocularis*, *E. vogeli* and *E. oligarthrus* respectively. Cystic and alveolar echi-

nococcosis are the two most important forms which leads to socio-economic significance (WHO, 2016) [1].

The definitive hosts are dogs and wild carnivores which excrete the parasite eggs with faeces on the pasture, while livestock are the main intermediate hosts and humans act as accidental intermediate hosts [2]. The egg ingested by livestock and hatched in the small intestine and penetrates the intestinal wall and moves the circulatory system into different organs, in particular the liver, lungs, heart, kidney and spleen [3]. Absence of proper meat inspection and presence of large population of stray dogs are contributed to the prevalence of a disease in animals and the common habit of

consuming uncooked meat is more serious to public health problems [4].

Globally, CE is estimated to affect approximately 2 to 3 million people worldwide, with Africa amongst the primarily endemic regions (WHO, 2016). [1]. In humans it causes severe morbidity and disability due to cysts developing in the liver and lungs. The occasional rupture of the hydatid cyst often leads to sudden death due to anaphylaxis, haemorrhage and metastasis [5]. In Ethiopia, annual economic losses due to CE from organ condemnation and carcass weight reduction range from 8,561.61 to 19,847,704.5 Ethiopian Birr (ETB) in Ethiopia [6,7] as reported by Nekemte and Bishoftu respectively.

In Ethiopia, several studies have been conducted to determine the prevalence and economic significance of bovine hydatidosis in different parts of the country [8]. Accordingly [9] reported that abattoir based studies showed that the prevalence of hydatidosis in ranges from 9.4% to 63.7% at Harar and Assella, respectively. However, there is no information about prevalence and economic losses due to bovine hydatidosis in Fedis District, so the present study is going to fill gaps and this finding will help the community to develop an appropriate preventative and control measures. Therefore, the objectives of this study were.

- To determine the prevalence of hydatidosis in cattle slaughtered at Fedis District, Boko slaughterhouse, Eastern Hararghe, Ethiopia.
- To estimate the annual economic losses due bovine hydatidosis in cattle slaughtered in the study area.

Materials and Methods

Description of the study area

The current study was conducted in Fedis District, Eastern Hararghe Zone, Ethiopia. The district was located in 549km East of Addis Ababa and 24km South of Harar. It shares the boundary with Midega Tola to the South, Gurawa to the West, Babile to the East, Haramaya to the North West and Harari region to the North direction. It contains 19 rural Kebeles (the smallest administrative unit) and 2 urban kebeles. The livelihood of the population is mainly based on agricultural resources including livestock production.

Study design

A cross-sectional study was conducted from November 2020 to June 2021 to determine the prevalence of bovine hydatidosis and its economic losses in cattle slaughtered in Fedis district, Boko slaughterhouse. Ante mortem examination was employed to assess the health status of animals and factors associated with prevalence

of bovine hydatidosis like sexes, age and body conditions of animals were recorded. Postmortem examination also employed by visual inspection, palpation and incisions of livers, heart, lungs and kidney were conducted for detection and determination of hydatid cysts in internal organs of slaughtered animals.

Study population

All of the study animals were local breed cattle of both sexes in different age groups (adult and old) and body conditions (medium, good and poor) brought to Boko slaughterhouse for the purpose of slaughtering. Age, sex and body condition of animals were also recorded during the study period. Cattle presented for slaughtering in the study area were mostly male with a few females. According to [10] the age of animals were categorized into adult (below or equal to 5 years) and old (above 5 years) based on dental eruption. The body condition of animals were categorized in to three groups as poor, medium and good as described by [11].

Sample size determination and sampling method

The sample size required for this study was calculated by taking an expected prevalence of 11.3% reported [12] from Harar City and using the formula given [13] with a 95% confidence interval (CI) and 5% desired absolute precision.

$$N = \frac{1.96^2 P_{exp}(1-P_{exp})}{d^2}$$

Where, N = required sample size, d = desired precision of 0.05 and Pexp = 11.3% expected prevalence. According to the above formula, 154 slaughtered animals were sampled for this study. Regular visits of slaughterhouse for five days per week were performed to conduct both anti-mortem and postmortem examinations. Using systematic random sampling methods in such a way that sampling units were selected at equal intervals with the first animal being selected randomly. Accordingly, three animals were sampled from a total of eight animals slaughtered per day.

Study Methodology

Ante mortem inspections were conducted to assess the health status of animals and to give identification number by using ink, and this number was transferred to all organs during post-mortem inspection. Postmortem examination was conducted using standard meat inspection procedures. The primary examination was conducted by visual inspection and palpation of the liver, lung, kidney and heart to detect the presence of hydatid cysts. The secondary examination was conducted by further incision of each organs suspected as positive for hydatid cysts. Each organ containing hydatid cysts were carefully removed and separately stored in clean

containers and transported to Boko Veterinary Clinic Laboratory to assess the status of the cysts. The total number of cysts obtained per organ, the number of positive organs and types of condemned organs were recorded.

Financial losses estimation

Financial losses due to hydatidosis mean due to condemnation of the liver, lung, heart and other organs and cost due to carcass weight reduction. Economic loss due to organ condemnation was determined by considering annual slaughter rate of cattle and the prevalence of hydatidosis per organ [14,15]. The monetary loss from organs condemnation was calculated by using the formula described [16] as follow;

$$LOC = [(NAS*ph)*[(plu*Cplu) + (Phr*Cphr) + (pli*Cpli) + (Pkid*Cpkid)]$$

- Where, LOC=loss due to organ condemnation,
- NAS = mean number of cattle slaughtered annually
- Ph = Prevalence of hydatidosis
- Pli = Percent involvement of liver
- Plu = Percent involvement of lung
- Cplu = Current mean price of lung
- Phh = Percent involvement of heart
- Cphr = Current mean price of heart
- Cpli = Current mean price of liver,
- Pkid = Percent involvement of kidney
- Cpkid = Current mean price of kidney.

The retail market price of average size offal (lung, liver, kidney and heart) and mean market cost of 1 kg beef at Fedis district Boko town was obtained from butchers and consumers by interviewed during the study period. The average annual slaughter rate of cattle in the study area were obtained from five years of retrospective data. Likewise, the following parameters were considered to estimate the economic loss due to carcass weight loss. Average carcass weight of Ethiopian local breed cattle is estimated as 108 kg and an estimated 5% carcass weight loss was considered [14]. The economic loss due to carcass weight loss was determined as described by [17] using the following formula.

$$LCWL = NAS*Ph*Cpb*5%*108 \text{ kg}$$

- Where, LCWL = Loss from carcass weight loss
- 108 kg = Average estimated carcass weight of Ethiopian local breed
- NAS = Average number of cattle slaughtered annually
- Ph = Prevalence of hydatidosis
- Cpb = Average current price of 1 kg beef at Fedis district Boko town. Finally, the total economic loss was calculated by considering the losses from organ condemnation and carcass weight loss as described [18]. Thus, Total loss = LOC + LCWL

Data analysis

The data collected during ante mortem and postmortem inspection were coded and entered into Microsoft Excel and analyzed by using SPSS version 20. The-square (χ^2) test was used to analyze the association between prevalence of hydatidosis and host factors like age, sex and body condition scoring of slaughtered cattle. P <0.05 was considered a statistically significant variation.

Results

Prevalence of bovine hydatidosis and its associated factors

A total of 154 local breed cattle were examined, and an overall prevalence of bovine hydatidosis was 17.5%. The present finding showed that statistically insignificant variation (p > 0.05) with respect to the sex of animals with a prevalence of 17.8% and 17% in males and females respectively. In this finding, a higher infection rate was recorded in old animals (33%) than young (8.2%) animals. Whereas the highest prevalence of bovine hydatidosis was recorded in animals with poor body condition (55%) and 13.4% and 9.6% in medium and good respectively. The statistical analysis showed that the prevalence of hydatid cysts was a significant difference (p < 0.05) between body condition and of animals (Table 1).

Distribution and number of cysts in different organs

Risk factors	Variables	No of Examined	No of Positive	X ² (P-value)
Sex	Male	101	18 (17.8%)	0(>0.05)
	Female	53	9 (17%)	
Age	Adult	97	8 (8.2%)	15.600(0.001)
	Old	57	19 (33%)	
BSC	Good	52	5 (9.6%)	18.236(0.001)
	Medium	82	11 (13.4%)	
	Poor	20	11 (55%)	
Total		154	27 (17.5%)	

Table 1: Prevalence of bovine hydatidosis based on associated risk factors.

The current study showed that a total of 40 organs were harboring more than one hydatid cysts and a total of 127 cyst were collected from all infected organs. The proportion of cysts per organ was significantly higher in the lung (43.2%) than liver, heart and kidney (Table 2).

Estimation of annual financial losses

- **Direct Economic Losses:** In this study, 26 lungs, 18 livers, 3 hearts and 2 kidneys were condemned due to infected with hydatid cysts. As information obtained from butchers and con-

Affected Organs	No of Positive organs	No of Cysts collected
Lung only	17(43.2%)	59(46.6%)
Liver only	9(22.5%)	33(26%)
Heart only	3(6.8%)	4(3.1%)
Kidney only	2(4.5%)	3(2.3%)
Lung and liver	9(22.5%)	28(22%)
Total	40	127

Table 2: Distribution and total number of cysts recorded in different organs.

sumers, in Boko town during the study period, a total of 600 local breed cattle were slaughtered per year and an average current price of lungs, liver, heart and kidney were 50, 200, 50 and 30 ETB respectively. Accordingly, the annual financial loss due to organ condemnation is estimated as follows:

$$\begin{aligned}
 \text{LOC} &= [(NAS \cdot ph) \cdot [(plu \cdot Cplu) + (Phr \cdot Cphr) + (pli \cdot Cpli) + (Pkid \cdot Cpkid)]] \\
 &= [(600 \cdot 17.5\%) \cdot [(26 \cdot 50) + (3 \cdot 50) + (18 \cdot 200) + (2 \cdot 30)]] \\
 &= [105] \cdot [1300 + 150 + 3600 + 60] \\
 &= [105] \cdot [5110] \\
 &= 536,550 \text{ ETB}
 \end{aligned}$$

- Indirect Economic Losses:** Based on the five years of retrospective data obtained from the slaughter house, 600 local breed cattle were slaughtered per year and the average current price of 1kg of beef in Boko town during the study period was 600 ETB and 5% carcass weight loss for an average 108kg of Ethiopian local breeds. Based on the above data, a total of 105 slaughtered animals were infected by hydatid cysts and the annual financial loss due to carcass weight reduction was estimated as follows:

$$\begin{aligned}
 \text{LCWL} &= NAS \cdot Ph \cdot Cpb \cdot 5\% \cdot 108 \text{ kg} \\
 &= [600 \cdot 17.5\%] \cdot [640 \text{ ETB} \cdot 5\% \cdot 108 \text{ kg}] \\
 &= [105] \cdot [640 \text{ ETB} \cdot 5.4 \text{ kg}] \\
 &= 105 \cdot 3456 \text{ ETB} \\
 \text{LCWL} &= 362,880 \text{ ETB}
 \end{aligned}$$

- Total Economic Losses:** The total annual economic loss was estimated by summation of losses to organ condemnation and carcass weight reduction.

$$\begin{aligned}
 \text{Total loss} &= \text{LOC} + \text{LCWL} \\
 &= 536,550 + 362,880 \text{ ET} \\
 &= 899,430 \text{ ETB}
 \end{aligned}$$

Discussion

Bovine hydatidosis is a parasitic disease which had Socio-economics importance all over the world its prevalence was higher in undeveloped countries including Ethiopia. The present finding

showed that 17.5% of an overall prevalence of bovine hydatidosis was recorded in the study area. The current finding was comparable with previous findings reported from Ethiopia [17,19,20] in Adama and Nekemte who found 17.1%, 17.1% and 18.6% respectively.

The current finding was higher than the findings [21-24]. in Juba, South Sudan, Debre Berhan, Northern Ethiopia, Baghdad, Iraq and Egypt who reported the prevalence Ethiopia, Baghdad% and 1.33% respectively. This finding was lower than the works [25-27]. in Shashemene, Adama and Hawasa who reported 47.2%, 52.5% and 40.2% respectively. This variation might be due to the difference between sample size, different ways of slaughtering and disposal of condemned organs, population of stray dogs and livestock management system.

The present study showed statistically insignificant difference ($P > 0.05$) with respect to the sex of the animals. This finding was in agrees with other studies conducted in Shashemene [25,27] reported the occurrence of hydatid cysts was an insignificant association ($P > 0.05$) between sexes of animals. This might be due to the fact that both sexes have an equal chance of acquiring the infections because of the same agro-climatic condition and husbandry practices.

The current study revealed statistically significant association ($P < 0.05$) was observed regarding age groups of animals with a higher rate of infection in adults than young with a prevalence of 33% and 8.2% respectively. This finding in lined with the works [27,28] reported the prevalence of bovine hydatidosis was higher in animals with older age than adults. This is due to because the adult animals have more chance due to the longer exposure time of aged animals to *E. granulosus* eggs and weaker immunity to resist the infection.

In this finding, the prevalence of bovine hydatidosis was statistically significant variation ($P < 0.05$) between body conditions with the highest infection rate of hydatid cysts were recorded in animals with poor body conditions (55%) followed by medium (13.4%) and good (9.6%). This finding is in agreement with other works reported [25,29,30]. found statistically higher prevalence of hydatid cysts in animals with poor body condition followed by medium and good. This might be due to the animals infected with hydatidosis having poor body condition being found to have high cyst burden and the reflections of the cyst's effects on the body of animals [28].

The current finding indicated that the highest proportion of hydatid cysts per organ was recorded in lung (43.2%) followed by the liver (25%), heart (6.8%), kidney (4.5%) and 25% in both lung and liver. Of the total 127 collected hydatid cysts, the highest number of cysts were recorded in the lungs 59(46.6%) followed by liver 33(26%), heart 4(3.1%), kidney 3(2.3%) and both lung and liver 28 (22%). This finding was comparable to the works [25,31]. in Shashemene Municipal Abattoir who found the highest number of cysts in lungs than other organs. This might be because, if cattle are slaughtered at an older age, during which the liver capillaries are dilated, most oncospheres pass directly to the lungs and damage them.

The total annual economic loss due to hydatidosis in cattle slaughtered at Fedis district Boko slaughterhouse was estimated to 899, 430 Ethiopian birr. The analysis of economic loss in this study was higher than the loss of 674,093 ETB in Addis Ababa [14], 180,792 ETB in Bako, Ethiopia [32] and 345,334.84 ETB in Gonder, Ethiopia [35]. Whereas the present finding was lower than 19,847,704.5 ETB found in Bishoftu [7] and 3,904,631.64 ETB in Dalo Mana, Ethiopia [33] and 6,524,087.2 ETB in Shashemene [34]. The difference in economic loss in various Abattoir or regions may be due to the variations in the prevalence of the disease, mean annual number of cattle slaughtered and variations in the retail market price of organs and beef per kg [12,33].

Conclusion and Recommendation

Hydatidosis causes considerable public health and economic significance all over the world. The present finding showed that 17.5% of an overall prevalence and 899, 430 ETB an estimated total annual financial loss due to bovine hydatidosis was recorded in the study area. Based on the current result, hydatidosis is an important neglected zoonotic disease of cattle which causes economic loss in livestock due to condemnation of organs and carcass weight losses of infected animals.

Therefore, based on the above conclusions, the following recommendations were forwarded.

- Well-equipped and standardized abattoirs should be established and slaughtering of animals outside the government abattoirs must be controlled.
- Veterinary professional provides public awareness in terms of knowledge of the zoonotic importance and economic significance of hydatidosis.
- An integration between veterinarians and public health personnel and policy makers through one-health approach is very crucial in order to control and prevent the disease.

- Expansion of abattoir facilities, establishment of well-equipped abattoirs, appropriate meat inspection and disposal of infected organs should be strengthened.
- Regular deworming of dogs and minimizing the population of stray dogs for disease control strategies should be supported by legislation.

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