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Prevalence, Cyst Characterization and Economic Importance of Bovine Hydatidosis in Addis Ababa Abattoirs Enterprise, Ethiopia

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ABSTRACT

A cross sectional study was conducted to determine the prevalence, cyst fertility and economic importance of bovine hydatidosis in cattle slaughtered at Addis Ababa Abattoirs Enterprise, Ethiopia. The study revealed 20.16% (98/486) occurrence of hydatidosis based on the postmortem examination of 486 cattle slaughtered and examined. Prevalence of hydatidosis is significantly associated with body condition score (P< 0.05) and higher prevalence was recorded in animals with poor body condition. However, there was no significant association between hydatidosis infection and age of the animals (P>0.05). Of the 98 viscera harboring hydatid cysts, the highest 57(58.17%) were found in lung followed by liver 24(24.49%), kidney 2(2.04%) and 1(1.02%) heart. In addition, out of the total 361 cysts collected 63(17.45%) were fertile, 210 (58.17%) sterile and 88 (24.38%) calcified. During viability test of fertile cysts, 33.33% hydatid cyst viability rate was observed. The rate of cyst calcification was higher in liver (43.24%) than in the lung (11.43%). Based on the study, the direct annual economic loss due to organs condemned at Addis Ababa Abattoirs Enterprise was estimated to be 345334.84 Ethiopian Birr. The present study showed higher prevalence of hydatidosis in Addis Ababa abattoir. Therefore to break the life cycle of hydatidosis, public education should be undertaken in addition to regular treatment of dogs and fencing the surrounding of the abattoir should be encouraged to reduce the spread of the disease.

Keywords: Abattoir, Addis Ababa, Bovine, Ethiopia, Hydatid cyst, prevalence

Ethiopia has the largest livestock population in Africa, with an estimated 49.3 million of cattle, 26.1 million of sheep and 21.7 million goats, 7.55 million of equines and 2.3 million of camels (CSA, 2009). However, the contribution from these huge livestock resources to the national income is disproportionate due to several factors. Among these diseases are the major factors responsible for poor production and productivity. Parasitic diseases are considered as the major obstacle in the health and production performance of livestock.

Hydatidosis caused by the metacestode of *Echinococuss granulosus* is a widely spread parasitic zoonosis that causes public health problems in many countries and causes considerable financial losses (Budke *et al.* 2006; Eckert and Deplazes, 2004; Kerimuribo, 2009). Factors governing the prevalence of hydatidosis in a given locality may be associated with prevailing specific social, cultural, environmental and epidemiological conditions. It has a considerable socio economic impact in countries where livestock industry is an important segment of agricultural sector and when livestock production is based mainly on extensive grazing system (Berhe, 2009). Similarly It's significance is higher in developing countries especially in rural communities where there is a close contact between dogs (definitive host) and various domestic animals which are intermediate host (Eckert and Deplazes, 2004). Studies conducted recently in abattoirs of various location indicate that *Echinococcus granulosus*, a causative agent of hydatidosis, is wide spread in Ethiopia with great economic and public health significance (Sisay *et al.* 2008; Nigatu *et al.* 2009).

Fragmentary works have been done on the prevalence and economic importance of hydatidosis in Ethiopia; however there are few studies that have been conducted on fertility

and viablity of hydatid cysts in Addis Ababa Abattoirs where backyard slaughtering of domestic animals, raw beef consumption and feeding stray dogs with condemned organs are common practices. Keeping in view the public health significance of hydatidosis in cattle, the present study was undertaken to elucidate the current prevalence, fertility and financial losses of bovine hydatidosis based on post mortem examination in the study abattoir and to assess important associated factors of bovine hydatidosis.

MATERIAL AND METHODS

The study was conducted at Addis Ababa Abattoirs Enterprise on the slaurhtered cattle brought from different parts of the country. Addis Ababa, the capital city of the country, is located on elevation of 2000 to 3000 m. above sea level at 9°1'48' North latitude and 38°44'24' East longitude. The mean annual rainfall in the area is 1800 with a bimodal pattern while the days mean annual minimum and maximum temperature are 14° and 21°C respectively (CSA, 2010).

A cross sectional study was conducted in the abattoir during the period between November 2013 and April 2014. All the slaughtered animals were male and local Zebu breed cattles originating from different localities and markets of the country.

The sample size of the required species of animals was determined using the formula of Thrusfield (2005). Using systematic random sampling methods and 95% confidence interval with required precision of 5%. The expected prevalence of hydatidosis was taken from previous work of Zelalem *et al.* (2012) at Addis Ababa abattoir which was 19.7%. The required minimum sample size was 243. However, in order to increase accurate precision a total of 486 cattle were sampled using systematic random sampling methods.

Regular visit of the abattoirs twice a week was performed to carry out both ante mortem and post mortem inspection of cattle slaughtered at the study abattoir. Pre-slaughter animals were inspected to determine body condition, age, sex and breeds. Body condition score was ranked as good, medium and poor as described by Thompson and Meyer (1994). Estimation of age was carried out by examination of the teeth eruption using the approach forwarded by Solomon and Kassahun (2009). Each studied animals were given an identification number (with a paint mark on their body). At post mortem examination, all visceral organs including liver, lung, kidney, heart and spleen were thoroughly examined by visual inspection, palpation and incision when necessary according to procedures recommended by FAO/WHO (1994).

The presence of hydatid cyst and affected organs were recorded. Each hydrated cysts was collected in ice box and taken to Yeka Animal Health laboratory for conducting cyst count, fertility test and viability of protoscolices. The pressure of the cyst fluid was reduced by using sterile needle. Then the cyst was incised with a sterile scalpel blade and the content was poured in to a petridish and examined microscopically (40X) for the presence of protoscolices. Cyst, that contained protoscolices was considered as fertile. Fertile cysts were further subjected to viability test. The viability of protoscolices was characterized by the presence of amoeboid like peristaltic movements with (40X) objective lenses. For clear vision a drop of 0.1% aqueous eosin solution was added in hydrated fluid on microscope slide with the principle that viable protocolices completely or partially exclude the dye while the dead ones take it up. The infertile cysts were also further classified as sterile (fluid filled cyst without any protoscolices) or calcified (Cyst produced a gritty sound feeling up on incision) as per the procedure given by Parijia (2004).

The Annual economic loss due to hydatidosis in cattle slaughtered at Addis Ababa Abattoirs Enterprise was estimated as the summation of cost of offal condemned plus the cost of carcass weight losses (Kebede *et al.* 2009; Getaw *et al.* 2010). The retail market price of average size offal (lung, liver, kidney, heart and spleen) and the cost of one kg beef were obtained from information gathered from local butchers. Annual economic loss due to organ condemnation was determined by considering annual slaughter rate of cattle and prevalence of hydatidosis per organ (Getaw *et al.* 2010) and an estimated 5% carcass weight loss (Polydorous, 1981), slaughter rates of animals at Addis Ababa abattoir enterprise, average carcass weight (dressing percentage) of Ethiopian zebu cattle breed was 108 kg and the carcass value of beef during the study period was about 85 ETB/kg. The annual carcass weightloss due to hydatidosis was: ACW = CSR × CL × BC × P, Where: ACW = Annual cost from carcass weight loss; CSR = average slaughtered cattle per annual in the

abattoir; CL = carcass weight loss in the individual = (108×5%); BC = average price of 1 kg carcass at Addis Ababa town; P = prevalence rate of hydatidosis at Addis Ababa abattoirs enterprise. Therefore, the total financial loss due to hydatidosis was the sum of organ condemned (direct) and the cost of carcass weight (indirect) losses (Negassa *et al.* 2010).

The data obtained was coded in Microsoft excel and subjected to descriptive statistics and chi-square in order to assess the magnitude of the difference of comparable variables using SPSS version 17.0 software. Statistically significant association between variables is considered to exist if the p-value is less than 0.05.

RESUITS AND DISCUSION

On ante mortem examination, all examined animals were normal and passed for slaughter. On post mortem, out of total 486 heads of cattle, 98 (20.16%) were infected with hydatid cyst (Table 1) harboring one or more cyst in different visceral organs.

Table 1: Prevalence of cattle hydatidosis according to different animal attributes

Categories	No examined	No. Positive	Prevalence	x^2	P-value
Age				11.98	0.53
<5 years	151	26	17.22		
>5 years	335	72	21.49		
Body condition				8.67	0.02
Good	264	19	7.19		
Medium	134	35	26		
Poor	88	44	50		
Total	486	98	20.16		

This prevalence was comparable to the reports of Zelalem *et al.* (2012), in the same study abattoir it was reported 19.7% and in Dere Dewa, it was 20. 05% by Miheret *et al.* (2013). But it was lower than the report of Zewdue *et al.* (2010) in Ambo, 29.7% and in Gonder, 28% by Endalew and Nuradis (2013). However this prevalence was higher than the studies conducted in Dessie, 13.6% by Melaku *et al.* (2012) and in Mekele, 17.5% by Gebremeskel and Kalayous (2009). The variation in the prevalence of hydatidosis from place to place may be due to the difference in strains of *E. granulosus* that exist in different geographical location (Parijia, 2004). Other factors may be due to difference in feeding habits, social activity and attitude of peoples in difference region (Azlaf and Dakar, 2006). Body condition was significantly affected the prevalence of hydatidosis (P< 0.05) and animals with poor body condition were with higher prevalence of hydatidosis. This finding was in agreement with the report of Yechale (2008), Zewdu (2010) and Zelalem (2012). The differences between body conditions score may be because animals with poor body conditions have low immunity to hydatidosis. Also moderate to severe infection of the parasite may cause retarded growth and weight loss (Polydorous, 1981).

Among the organs examined in this study, lungs were the the most commonly affected organ 57(58.163%) followed by liver 24(24.489%), kidney 2(2.04%) and heart 1(1.02%) (Table 2). This might be due to the liver and lungs possess greater capillaries that act as partial barriers for the ingested hexachant embryos taking the portal vein route and primarily negotiate the hepatic and pulmonary system sequentially before any other peripheral organ invasion (Estagil and Tuzer, 2007). Similar findings were reported from different regions of Ethiopia by (Zelalem, 2012), (Yechale, 2008) and (Endalew and Nuradis, 2013) and from other countries such as from Iran by (Radfar *et al.* 2004).

Table 2: Distribution of hydatid cyst in different visceral organs of infected cattles

Organs	No.of examined	No. of cases	Prevalence (%)	Proportion from infected animals
Lung	486	57	11.73	58.16
Liver	486	24	4.94	24.49
Kidney	486	2	0.41	2.04
Heart	486	1	0.2	1.02
Spleen	486	—	—	—
Lung an liver	486	14	2.88	14.28
Total	486	98	20.16	100

The result of this study revealed that only 17.45% of the cysts were fertile while, 58.17% and 24.38% of the cysts were sterile and calcified respectively. This finding was comparable with the work of (Zelalem, 2012) who reported from the same study abattoir of (19.3%) fertile, (55.4%) sterile and (25.3%) calcified cysts. The fertility rate in the

current study is higher as compared to previous reports, 10.66% by Berhe *et al.* (2010) and 14.95% by Terefe *et al.* (2012). But lower than in other studies, 31.39% by Endrias *et al.* (2010) and 19.3 by Fikire *et al.* (2012). The variation in fertility rate in different species and in different geographical area might be due to the difference in the strains of *Echinococcus granulose* (Parijia, 2004).

Table 3: Types and proportion of hydatid cyst in different organs

Organ involved	Types of cysts			
	Fertile (%)	Sterile (%)	Calcified (%)	Total (%)
Lung	51(24.28)	135(64.28)	24 (11.43%)	210(58.17)
Liver	12(8.10)	72(48.65)	64(43.24)	148(40.99)
Kidney	—	2 (100)	—	2(0.55)
Heart	—	1(100)	—	1(0.28)
Total	63(17.45)	210(58.17)	88(24.38)	361(100)

The percentage of fertile cysts observed in this study was higher in lungs (80.95%) than in liver (19.05%). Similarly viable protoscolies were higher in lung (25.39%) origin hydatid cysts followed by liver (7.93%), which is in agreement with other study in cattle in Ethiopia (Tolossa *et al.* 2009).

Table 4: Viable and non viable cyst with respect to the organ involved

Organ involved	Viable (%)	Nonviable (%)	Total (%)
Lung	16(31.37)	35(68.68)	51(24.28)
Liver	5(41.66)	7 (58.33)	12(8.1)
Total	21(33.33)	42(66.66)	63(17.45)

Out of the total 63 fertile cyst which were examined for viability test 16 cysts from lung and 5 cysts from liver, were viable (Table 4). This may be due to the softer consistency of the lung tissue that allows the easier development of the cyst (Parijia, 2004). The overall prevalence of viable cyst in this study was, 33.33% (table 4), this indicates that cattle are important intermediate host for the life cycle of the parasite.

The annual economic loss due to bovine hydatidosis at Addis Ababa Abattoir Enterprise from organ condemnations was estimated to be 163,468.84 ETB annually and due to carcass weight loss was 181,866 ETB. The total annual economic loss due to hydatidosis in cattle slaughtered at Addis Ababa Enterprise was estimated to be 345, 334.84 Ethiopian birr which is huge financial loss for Ethiopia where the per capita income per day is less than 1 USD (Togerson and Budke, 2003). The economic loss as per this study is lower than the loss of 674,093 Ethiopian birr in Gonder of northern Ethiopia reported by Endalew (2014), but higher than the economic loss reported by Zewdu (2008), 160,032.23 Ethiopian birr in Ambo municipal abattoir. The difference in economic loss analysis in various abattoirs may be due to the variations in the prevalence of the disease, mean anual number of cattle slaughtered in different abattoirs and variations in the retail market price of organs (Azlaf and Dakar, 2006).

Table 5: Organ condemnation rate due to Hydatidosis and current retail marked in, 2012-2013

Organ	Prevalence (%)	Price in (ETH)
Lung	11.7	10
Liver	4.5	40
Kidney	0.45	15
Heart	0.2	30
Total	20.16	95

Bovine hydatidosis is public health risk and causes considerable economic loss via decreasing livestock production and condemnation of offals in slaughter houses. The abattoir survey evidence of the present investigation showed that hydatidosis is prevalent in cattle population in Addis Ababa city and its surroundings. This is associated with backyard slaughtering with throwing of visceral organs everywhere, presence of more stray dogs which feed on condemned organs, low public awareness about hydatidosis and keeping dogs in close association with animals and humans. Measures like, prohibition of backyard slaughter, proper disposal of condemned offals, regular deworming of dogs and creation of public awareness about the disease are recommended.

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