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Prevalence and Economic Worth of Bovine Hydatidosis in Abyssinia Export Abattoir, Bishoftu, Ethiopia

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Abstract: A cross-sectional study aimed to determining the prevalence bovine hydatidosis and estimating the financial loss due to cystic echinococcosis (hydatidosis) in cattle slaughtered at Abyssinia export abattoir was conducted from November 2017 to March 2018. Routine ante-mortem and post-mortem inspection was conducted on 600 randomly selected animals. Out of these cattle examined, 124(20.7%) were found to harbor visible hydatid cysts. The prevalence of the disease was no statistically significant difference among breed, sex, body condition score and age groups ($p>0.05$). However, it was not statistically significant ($P>0.05$) distribution of the disease was, 22.8% in medium and 19.8% in good body conditioned. The prevalence of hydatidosis in relation to age 18.9% in (<5 years) and 21.7% in (> 5 years) animals. Regarding organ distribution, infections of the liver, kidney, lung and heart were 10.5%, 0.83%, 8.83 % and 0.5% respectively. Of the total 156 hydatid cysts counted 38(24.4%) were fertile, 37(23.7) were sterile and 81(51.9) were calcified. Of the 38 fertile cysts subjected for viability test 19(50%) were viable while 19(50%) were non-viable. Moreover, assessment of annual economic loss due to bovine hydatidosis at Abyssinia export abattoir from offal condemnation and carcass weight loss was estimated at 1,598,836.2, Ethiopian Birr. Bovine hydatidosis is an important disease that causes great economic losses due to organ condemnation and weight loss in the study area. Improvement of awareness of the communities about the transmission mechanism and economic importance of the parasite and hence reducing the incidence and economic loss incurred by the disease via control program that involves due attention on veterinary activities.

Keywords: Abattoir · Bishoftu · Bovine · Hydatidosis · Prevalence

INTRODUCTION

The world human population is growing at a rate much faster than food production and increase is mainly developing countries, which are unable to assure adequate food to their people. Developing countries have nearly two third of the world's livestock production but produces less than a third of the world's meat and a fifth of its milk [1].

The livestock resource contributes about 30-35% of agricultural gross domestic product and more than 85% of farm cash income and also it provides draught power for cultivation, the house hold meat and transport, milk and meat and its major source of cash and store of wealth for the rural population [2].

Ethiopia's livestock productivity, despite its huge population size, remains marginal due to high prevalence of animal diseases, malnutrition and management constraints. Among animal diseases; parasitism represents a major obstacle to the development of livestock sector and hampers the poverty alleviation programs in livestock farming system in the country [3]. However, the contribution from these huge livestock resources to the national income is insignificance due to several factors. Among them, parasitic diseases are considered as a major obstacle in the health and product performance of livestock. These parasitic diseases are distributed throughout the world and affect animal health resulting into a low working potential and reduced productivity. Amongst these parasitic diseases,

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hydatidosis is one of the most important parasitic diseases, which affects the efficiency of both animals and human being [4].

Hydatidosis is a chronic parasitic zoonotic disease, a name given to a condition due to infection with the larval stage of the dog tapeworm, *Echinococcus granulosus*. It occurs throughout the world. It is of considerable public health hazard and economical losses due to decreased [5].

Knowledge about the prevalence of the diseases together with associated risk factors as part of the epidemiology of the disease is crucial for any attempt of prevention and control of the disease in determination of the economic significance of the disease is important for decision making, planning, development and implementation of local control strategies. It is also important to study the fertility of Hydatid cysts as it will help to understand the risk of spreading of the disease both to domestic animals and humans. Even though there were several works done in bovine species, little attention and information is available about its prevalence and economic significance of hydatidosis in bovine in Abyssinia export abattoir. The main objectives of this study were to estimate the prevalence of hydatidosis and estimate the economic loss from organ condemnation and carcass weight loss due to hydatidosis in bovine slaughtered in Abyssinia export abattoir.

MATERIAL AND METHODS

Study Area: Abyssinia Export Abattoir is a private Limited Company Established in 2013 with a total investment of birr 120 Million. The Company's Head office is located in Addis Ababa, Bole Sub City, whereas the Abattoir's location is in Bishoftu city just 47 Km away from Addis Ababa.

The study was conducted from November 2017 to March 2018 at Abyssinia export abattoir in Bishoftu town, Oromia region, Ethiopia, where 600 hundred cattle's are accessible from different districts of the region and from neighboring regions of the country for slaughter. The annual average rainfall is 871mm. It is located in latitude and longitude of 8°44'4.74"N and a longitude of 39°0'30.73"E and an elevation of 1978 meters. The average temperature was 20°C [6].

Study Population: Animal populations for this study were cattle brought to the abattoir from different areas. Breed, sex, age and body condition accordingly, those animals were subjected as a study population for active abattoir survey. During the study period a total of 600 were examined for the presence of hydatid cyst.

Sample Size Determination: The total number of cattle required for the study was calculated according to using the formula described [7]. Simple random sampling was used to select the by considering 50% [8] expected prevalence and 95% confidence level with a 5% desired absolute precision. Thus:

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

where n= sample size, p= Expected prevalence and d= Desired level of precision (5%). Even though the required sample size was 384, additional 216 samples were included to increase the precision so that 600 animals were included in the study.

Study Design: A cross sectional was conducted from November 2017 to March 2018 to determine the prevalence and financial loss of Hydatidosis at Abyssinia export abattoir using post-mortem examination of liver, kidney, lung and heart from each slaughtered animal.

Sampling Methods: Simple random sampling technique was used to select animals slaughtered in the abattoir. The animals were selected at the entrance to the abattoir identified by their owner's name, coded and recorded accordingly on a format prepared for this purpose.

Sample Collection: The active abattoir survey was conducted during meat inspection on randomly selected 600 cattle slaughtered at Abyssinia export Abattoir. In the survey, study animal were selected by simple random sampling on the basis of the entrance of animals into lairage. In line with these, associated risk factors such as age, sex, origin, breed and body condition score were recorded during anti-mortem inspection. During ante-mortem inspection each week, two days visit was made for ante-mortem inspection on individual animals for assessment of associated risk factors. Every visit, each animal was identified based on enumerated marks on its body tagging before slaughter. Animal origin was also recorded as where they bought from. The age of the animals was estimated on the basis of the dentitions and is conventionally classified as adult (<5 years) and above old (>5years) [8]. Postmortem examinations were thoroughly carried out by visual inspection, palpation and systematic incision of each visceral organ particularly the lung, liver, kidney and heart carried out according to procedures recommended [9].

Examination of Cyst and Checking the Fertility and Viability: The content of cyst was aspirated with the syringe to decrease its pressure and collected in a graduated beaker. The content was allowed to stay on incubator for 30 min at 36°C to settle the content and about 10ml of these sediments was poured to the test tube and centrifuged at 1000 rpm for 3min to separate the contents clearly from the liquid part. The supernatant was discarded and the sediment with some fluid was left in the test tubes. The examination was done under objectives (x40) magnification for the presence/absence of protoscolex. The protoscolices present as white dots on the germinal epithelium or brood capsule or hydatid sands within the suspension, the cyst categorized as fertile. Then the fertile cysts further subjected for viability test. For clear vision a drop of the sediment consisting of protoscolices placed on microscope glass slide and a drop of 0.1% aqueous eosin solution added and covered by cover slip and observes under microscope (x40), with principle that viable protoscolices exclude the dye while dead ones take it up. Furthermore, fertile cysts were characterized their smooth inner lining usually with slightly turbid fluid in its content. The infertile cyst classified as sterile or calcified. Typical calcified cysts produce a gritty sound feeling upon incision [10].

Economic Loss Evaluation: In this study, a four months active abattoir data were used to determine the direct financial losses due to hydatidosis means due to condemnation of liver, kidney, lung and heart (Direct) and cost due to carcass weight reduction (Indirect loss) were carried out. Annual economic loss due to organ condemnation was determined by considering annual slaughter rate of cattle and prevalence of hydatidosis per organ and an estimated 5 % carcass weight loss was considered [11]. Average carcass weight of Ethiopian local breed cattle is estimated as 126 kg [12].

Direct Economic Loss Due to Organ Condemnation: The economic loss due to condemnations of organ was assessed using the following formula developed by (Abebe, 2007): Direct loss (DL) = (NAS x PHlu x CPlu) + (NAS x PHli x CPli) + (NAS x PHk x CPk) + (NAS x PHh x CPh). Where: NAS- average number of animals slaughter annually, PHlu- percentage of lung condemnation due to hydatidosis, CP- current average price of lung, PHli-percentage of liver condemnation due to hydatidosis, CPli current average price of liver, condemnation due to hydatidosis, PHk-percentage of kidney condemnation due to hydatidosis, CPk-current average price of kidney, PHh-percentage of heart condemnation due to hydatidosis and CPh-current average price of heart [13].

Indirect Weight Loss Due to Hydatidosis: It was estimated that five percent carcass weight was lost due to hydatidosis [11]. The average carcass weight (Dressing percentage) of Ethiopian zebu slaughtered cattle was 126kg and the carcass value of beef during the study period was about 200 ETB/kg. The annual carcass weight loss due to hydatidosis:

$$ACW = CSR \times CL \times BC \times P$$
$$ACW = CSR \times 126 \times 5\% \times BC \times P$$

where:

ACW = Annual cost from carcass weight loss;
CSR = Average slaughtered cattle per annual in the abattoir;
CL = Carcass weight loss in the individual (126×5%);
BC = Average price of 1 kg carcass
P = Prevalence rate of Bovine hydatidosis.

Therefore, the total financial loss due to hydatidosis was the sum of organ condemned (Direct) and the cost of carcass weight losses (Indirect).

Data Analysis: The data collected from ante-mortem, post-mortem and laboratory findings were entered in to MS Excel spread sheet and analyze by using SPSS statistical software package version 20. The proportions of Hydatidosis infection in samples from the abattoir were computed.

Variables were considered using Chi-Square test. Logistic regression was used to reveal the strength of the association of the risk factors with positivity of sample. Confidence interval of the differences and significance were assumed by cross tabulation of different groups of risk factors like ages, origins and body conditions contributing to the prevalence of hydatidosis and any result with p-value < 0.05 was considered as statistically significant difference and influence of organ nature on cyst distribution was also analyzed with same statistical method.

RESULTS

Over all Prevalence: From the total of 600 cattle examined 124 (20.7%) were infected with hydatid cyst, harboring one or more cysts involving different visceral organs (Table 1).

Table 1: The total prevalence of bovine hydatid cyst of cattle slaughtered at Abyssinia export abattoir Bishoftu.

Types of examination	Number of Examined animals	Number of Positive animals	Prevalence %
Post mortem finding	600	124	20.7

Table 2: Prevalence of hydatidosis in different body conditions and age groups

		Organ types										
		Liver		Kidney		Lung		Heart		Total		
Factors	Category	N	n(%)	N	n (%)	N	n(%)	N	n(%)	N	n	%
BSC	Medium	180	17(9.4)	180	3(1.7)	180	20(11)	180	1(0.6)	180	41	22.8
	Good	420	46(11)	420	2(0.5)	420	33(7.8)	420	2(0.5)	420	83	19.8
Age	<5 yrs	227	25(11)	227	1(0.4)	227	17(7.5)	227	0(0)	227	43	18.9
	>5yrs	373	38(10.2)	373	4(1.2)	373	36(9.6)	373	3(0.8)	373	81	21.7
	Total	600	63(10.5)	600	5(0.83)	600	53(8.8)	600	3(0.5)	600	124	20.7

NB: N-number of examined animals, n-number of positive animals, yrs-Years, BSC-Body condition

Table 3: Fertility/sterility, viability and calcified cysts collected from different organs of Cattle slaughtered at Abyssinia export abattoir

Organ	Fertile cyst (%)	Sterile cyst (%)	Calcified cyst (%)	Viable	Non-viable
Liver	20(26.3)	19(25)	37(48.7)	9(47.6)	11(52.4)
Kidney	2(22.2)	1(11.1)	6(66.7)	2 (100)	0(0)
Lung	16(23.5)	16(23.5)	36(52.9)	8(50)	8(50)
Heart	0(0)	1(33.3)	2(66.67)	0(0%)	0(0%)
Total	38(24.4)	37(23.7)	81(51.9)	19(50)	19(50)

Table 4: Association between some of the risk factors with occurrence of Bovine hydatidosis in Abyssinia export abattoir

Factors	Category	N	Prevalence N (%)	X^2	Df	P-value	OR	95%CI	P-vale
Body condition	Medium	180	41(22.8)	4.09	1	0.39	1	Ref	
	Good	420	83(19.8)				1.2	0.78,1.83	0.4
Age	<5 years	227	43(18.9)	3.48	1	0.48	1	Ref	
	>5years	373	81(21.7)				0.3	0.56, 1.3	0.42

NB x^2= chi-square, df=degree of freedom, OR =odd ratio, CI= confidence interval

Body condition and Age wise prevalence: Hydatid infection at different age, body condition and origin in affected groups is described in Table 2. The result indicates that there was no statistically significant difference (P> 0.05) in age, origin and body condition of affected animals.

Fertility Test and Viability Test: Out of 156 cysts tested for fertility, observation indicated that 20 (12.82%) cysts of liver, 16 (10.25 %) cysts of lung origins and 2(1.92%) cyst of kidney had protoscolices detected and hence, fertile. The rest were either sterile or calcified. A total of 38 fertile cysts originating from lung, kidney and liver were tested for viability. The examination indicated that 8 cysts from lung 2 cyst from kidney and 9 cyst from liver origin had viable protoscolices showing the amoeboid like peristaltic movement (Flame cell motility) and up staining with 0.1% aqueous eosin solution, the viable protoscolices partially/totally excluded the dye while the dead ones take it up (Table 3).

Association with Some of the Risk Factors: Association of different potential risk factors with Bovine Hydatidosis prevalence in Abattoir was checked by chi-square test. As indicated in Table 4, age, body condition and origin had no statistically significant association with the prevalence of Bovine hydatidosis in Abyssinia export abattoir (P>0.05).

Economic Loss due to Organ Condemnation: A total of, 63 livers, 5 kidneys 53 lungs and 3 hearts were condemned due to hydatidosis with an economic loss 28,350 ETB, 498 ETB, 4768.2 ETB and 300 ETB respectively. This was calculated from mean retail market price of cattle liver (45birr), kidney (10 birr), lung (9 birr), heart (10 birr) and the total number of organs condemned during the study period. On the other hand annual economic loss was determined by considering annual slaughter rate of cattle was 6000 and prevalence of hydatidosis per organ and was calculated to be 15,016.3ETB losses per annum (Table 5).

Table 5: Direct economic losses associated with hydatid cyst in infected cattle in Abyssinia export abattoir

Organ	No of organs condemned	Unit price	Total price ETB
Liver	63(10.5%)	15	6,000×10.5%×15=28,350
Kidney	5(0.83)	10	6,000×0.83×10=498
Lung	53(8.83%)	9	6,000×8.83%)×4768.2
Heart	3 (0.5%)	10	6,000×0.5%×10=300
Total	124(20.7%)	79	33,916.2 ETB

LOC = (NAS × Pli × Cpli) + (NAS × Pki × Cpki) + (NAS × Plu × Cplu) + (NAS × Phr × Cphr)

LOC=6000×10.5%×45+6000×0.83×10+6000×8.83%) ×9+6000×0.5%×10=33,916.2 ETB

Economic Loss due to Carcass Weight Loss: A 5% carcass weight loss due to hydatidosis (Getachew, 2010) was considered have to estimate the economic loss and computed result showed a loss of 1,564,920 ETB per annum.

ACW = CSR ×126 × 5% × BC × P, where CSR=6000, BC=200, P=20.7

ACW=6,000×126 × 5% ×200×20.7%
ACW=1,564,920 ETB

Therefore, the total estimated economic loss in cattle slaughtered at Abyssinia export abattoir during the study period was,

TL=LOC+ACW
TL=33,916.2 ETB +1,564,920ETB= 1,598,836.2 ETB

DISCUSSION

In the present study, the prevalence of *Bovine hydatidosis* on cattle slaughtered at Abyssinia export abattoir was found to be 20.7% (N=600 or number examined cattle), which is comparable with the finding 22% in Tigray [14]. However; it was lower than studies undertaken different places of Ethiopia like 34.05% from Bahir Dar [15] and 29.69% from Ambo [16] were reported. The occurrence of such a low prevalence in the current site might have been happened due to reduced backyard slaughter practice and decrease in the population of stray dogs.

The present finding of bovine hydatidosis was a higher than the prevalence of 16.85% [17] and 16.0% [18] from Wolayita sodo respectively. Factors like difference in, animal husbandry systems, lack of proper removal of infectious carcass and attitude to dogs in different regions might have contributed to the variation in prevalence in different areas of a country [11]. The possible reason for the variation in the prevalence rate in different regions may be attributed mainly to strain difference of *Echinococcus granulose* that exists in different geographical situations. Moreover, other factors like difference in culture, awareness and social activities in different regions may contribute to these variations [19].

In this study there was no statistical variation in the prevalence rates between the areas where the examined animals comes from (Adami tulu, Borena and Wonji). The prevalence of hydatidosis was statistically not significant with the age of the animal (P-value >0.05). No significant differences in hydatid cyst prevalence were observed between body conditions. However, higher prevalence was observed in cattle having medium (22.8 %) than good (19.8 %) body condition. Similar findings were reported by Tadesse *et al*. [20] from Nekemte Municipal Abattoir.

This study shown that cysts identified are highly concentrated in liver and lung with prevalence liver 63 (10.5%), lung 53 (8.83%) followed by kidney 5(0.83%) and heart 3(0.5%). This result is agreed with other studies in cattle by Abera *et al*. [21]. This could be due to the fact that liver and lung are the first large capillary fields encountered by the blood born onchosphere and have larger capillary bed than any other organ [22] With regard to fertility and viability of cysts, the findings of 23.7% sterile, 24.4% fertile (50% Viable and 50% nonviable) and 51.9% calcified cysts in cattle may generally imply that most of the cyst in cattle is calcified.

In the current study, it was emphasized to carry out an assessment on annual economic loss due to bovine hydatidosis at Abyssinia export abattoir. Losses from offal condemnation and carcass weight loss (Meat production loss) in infected cattle were assessed and estimated to be 1,579,936.3 ETB. Previous studies have also estimated the annual financial losses associated with bovine hydatidosis from other parts of the country. The current estimate is greater than 410,755.90 ETB from Wolayita Sodo municipal abattoir Bekele and Butamo (2011), 314,756.39 ETB from cattle slaughtered at the Jimma abattoir [23].

The difference in the calculated economic loss in the various abattoirs is either due to the variation in the number of slaughtered animals or variation in the prevalence rate of hydatidosis or due to variation in the

retail market price of organs. Based on our results, we suggest that bovine hydatidosis is among many of the livestock diseases prevailing in the country incurring both direct and indirect losses to the cattle due to condemnation of organs and reduced live weight gain of infected cattle.

CONCLUSION AND RECOMMENDATIONS

From the present study, it can be concluded that hydatidosis was one of the most important parasitic diseases in cattle slaughtered at Abyssinia export abattoir. However, the overall prevalence in the study is low it is an important disease of economic causing organ condemnation and weight loss in area. The lung and liver were the most frequently affected body organs. In terms of frequency and fertility of the cyst the livers and lungs were found to be the most preferred predilection site. The huge financial losses due to organ condemnation reflect the economic impact of hydatidosis which deserves serious attention by the various stakeholders.

Based on these facts, the following recommendations are forwarded:

- ✓ A control program should be designed via dog registration to reduce the number of stray dogs and proper disposal of infected organs in abattoir should be applied.
- ✓ Regular deworming of household dogs and raise the awareness of abattoir workers and butchers on the public health significance of condemned offal.

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