

Economic and Zoonotic Importance of Bovine Hydatidosis in Shire Municipal Abattoir, North West Zone, Tigary Region, Ethiopia

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Abstract: A cross-sectional study was conducted from October to December 2010 in Shire municipal abattoir to assess the current status of hydatidosis in cattle. Hydatid cyst count and characterization were conducted based on routine meat inspection. Of the total 540 males zebu cattle slaughtered in Shire municipal abattoir 140 (25.92%) cattle were found harbouring hydatid cysts with no statistical significant association of the disease among months ($p>0.05$). Thorough meat inspection in the abattoir revealed that 173 visceral organs were found harbouring one or more hydatid cysts in cattle. More than 98% of the infected organs were found in lungs and livers. Lungs were the highest infection. Rates out of 173 cysts, 115 (66.47%) in the lung, 55 (31.79%) in the liver, 3(1.73%) in the heart were found. The total annual economic loss due to the direct and indirect losses was estimated to be 366,939.95 birr per annum, which is 48 birr per one kilogram beef, 32 birr per liver, 5 birr per lung and 7 birr per heart. Results of the study revealed that hydatidosis is one of the major disease causing direct and indirect economic losses significantly on the study area. Control strategies should be initiated immediately taking into account the social, cultural and the economic condition of the people. Furthermore, to break the life cycle, public education on the habit of feeding of condemned organs to dogs should be provided and prevention of dogs access to condemned organs from abattoirs by disposal.

Key words: Hydatidosis • Meat Inspection • Bovine • Prevalence • Economic Loss • Abattoir • Shire

INTRODUCTION

Hydatidosis is a term used to describe the infection of animals with metacestode stage of echinococcus species [1]. Hydatidosis is one of the major parasitic problems of domestic animals and zoonotic diseases that cause considerable economic losses and public health problems worldwide [2]. This multi host parasite is prevalent all over the world and annually the economic loss in livestock due to this parasite is significant. In Africa, hydatid disease is reported more common in cattle those are communally owned or are raised of free range and which associated more intimately with domestic dogs. Hydatidosis in domestic ruminants inflicts enormous economic damage due to the condemnation of the affected organs and lowering of the meat, milk and wool production [3,4].

Factors governing the prevalence of hydatidosis are given locally being associated with prevailing specific social, cultural, environmental and epidemiological situations. Human behaviour plays a significant role in the epidemiology and the dynamic of transmission differ between the dog and its normal intermediate and human hosts [5,6]. The outcome of the infection in livestock is hydatid cyst development in the lung, liver, spleen, kidney etc [7].

In Ethiopia, hydatidosis has been known and documented as early as 1970's. Hydatidosis is the major cause of organ condemnation in most Ethiopian abattoirs and slaughter houses causing huge economic losses [3, 8]. In Ethiopia, studies conducted in different abattoirs indicated that cystic hydatidosis is prevalent and considerable economic losses are associated with it.

Certain deeply rooted traditional activities could be commonly described as factors substantiating the spread and high prevalence rates of the diseases in some areas of the country. These may include the widespread backyard animal slaughtering practice, the corresponding absence of rigorous meat inspection procedures and long standing habit of the most Ethiopian people to feed their dogs with condemned offal which in effect, facilitate the maintenance of the perfect life cycle of *E. granulosus* and consequently high rate of infection of susceptible hosts [9].

In Shire, there was no known research undertaken about hydatid disease in abattoir. But it is expected to be highly prevalent due to wide spread of backyard slaughtering practices, the absence of meat inspection procedures and the long standing habit of the people to feed their dogs with raw offal's.

In Tigray, particularly in North West zone, livestock rising is an important activity from which food and non food commodities are produced. Livestock plays a key role in the daily life of the population; particularly, the peasant owns over 95% of the country. But the productivity remains very low due to lack of disease control and poor husbandry practice. Hydatid disease/Echinococcosis is one of the diseases which decrease productivity and zoonotic importance. These were the points which initiated the research to be done on the topic of hydatid disease/echinococcosis. The objectives of this study were to determine the prevalence rate and economic importance of bovine hydatidosis at shire municipal abattoir and to assess organ condemnation due to hydatid disease and to recommended relevant control strategies pertinent to the prevailing local situation.

MATERIALS AND METHODS

Study Area: The study was conducted from October to December, 2010 in Shire, North West Zone, at shire municipal abattoir in Tigray regional state located in the northern Ethiopia. Shire is 1087 km far away from Addis Ababa with an altitude of 1600-2200 meter above sea levels, the rain fall gets in summer season 700-1135 mm (877.6 mm), the temperature ranges 18-34.6°C. Livestock population of the woreda has a total head of 116092 of cattle, 42567 sheep, 10577 of goats, 8799 of donkeys and horse, 95 of mules, 428 of camel, 14832 of chickens and 9714 honey bee colonies. The area was covered by different trees, shrubs, herbs and grasses [10].

Study Population: The study animals comprise indigenous zebu cattle slaughter at shire municipal abattoir. These cattle presented for slaughtering was local breeds (Begait and Arado).

Study Design: A cross sectional abattoir survey was conducted from October-December, 2010 at Shire municipal abattoir. Both antemortem and postmortem inspection procedures were carried out during this study period.

Sample Size: Since there is no study conducted previously about the prevalence and economic importance in Shire abattoir. So the prevalence is expected to be 50% according to Thrusfield [11]. However, estimate the prevalence of bovine hydatidosis and its economic importance in the municipal abattoir, a thorough meat inspection was conducted on 540 head of cattle during the study period.

Sampling Techniques: Simple random sampling technique was used daily to identify the study animals for inspection purpose during the study period.

Data Collection

Antemortem Inspection: Following the simple random sampling technique, ante mortem inspection was used daily for the assessment of animal's origin and body condition. During every visit, each animal was identified based on enumerated marks on its body tagging before slaughter and assessment of the body condition was carried out. These and other necessary information's was recorded.

Postmortem Inspection: Following a thorough visual inspection, palpation and incision of some suspected organs (such as liver and lung) [12]. All the hydatid cysts found in these organs were collected to conduct the cyst measurements and cyst count. All infected organs condemned due to hydatidosis were registered.

Prevalence Study: From October to December 2010, liver, lung, heart and kidneys; a minimum 540 local cattle breed were examined following the postmortem meat inspection procedures for prevalence study. The suspected organs (especially liver and lung) of the slaughtered animals were examined by thorough inspection palpation and systematic incision to recover hydatid cyst.

Assessment of Economic Losses: The loss due to hydatidosis in shire municipal abattoir was estimated by direct and indirect losses;

Direct Organ Condemnation: Lung, heart and livers were condemned due to hydatidosis. Annual cost of the condemned organs due to bovine hydatidosis was assessed during the following formula set by Ogunirad *et al.* [13].

$$ACLLKHC = CSR \times PL1C \times L1C + CSR \times PL2C \times L2C + CSR \times PKC \times KC + CSR \times PHC \times HC$$

Where, ACLLKHC=Annual cost of liver, lung, kidney and heart condemned.

CSR= average number of cattle slaughtered per annual at abattoir Shire

PL1C= percentage of liver condemned

L1C=mean cost of one liver

PL2C= percentage of lung condemned

L2C= mean cost of one lung

PKC=percentage of kidney condemned

KC= mean cost of one kidney

PHC= percentage of heart condemned

SHC= mean cost of one heart.

Indirect Weight Loss/ Carcass Weight Loss Due to Hydatidosis: A 5% carcass weight loss due to hydatidosis in cattle has been described by [14] and an average carcass weight of Ethiopian cattle is 126 kg [15]. Therefore annual carcass weight loss due to hydatidosis is:

$$ACW = CSR \times CL \times BC \times P$$

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

Where; ACW= annual cost from carcass weight loss

CSR=average slaughter cattle per annual in the abattoir

CL (126 x 5%) = carcass weight loss in the individual

BC= average price of one kg carcass at shire town

P= prevalence rate of hydatidosis at shire abattoir

Total economic loss=A+B, where;

A=Annual cost of organs condemned

B=Annual cost carcass weight losses.

Data Analysis: The data was presented using the descriptive statistics method. These findings may be

presented in figures, tables and stored in Microsoft excel spread sheet program and subjected to chi square statically analysis.

RESULTS

Abattoir Survey: During the study period of 540 cattle inspected, 140 were positive i.e. the prevalence rate was 25.92% monthly prevalence of hydatidosis found in this study was 25% in October, 26.8 in November and 25.56% in December.

During the study period cyst distribution was assessed based on organ wise. That is 85(60.71%) lung only, 25(17.86%) liver only, 27(19.285%) lung and liver, lung, liver and heart all are 3(2.14%) as it could seen on table 2.

There was about 173 condemned organs, of which 115(66.47%), 55(31.79%), 3(1.73%), lung, liver and heart were condemned respectively as it was seen (Table 3).

Economic Loss Assessment: A total of 115 lung, 55 liver and 3 heart were condemned due to hydatidosis with the economic loss of 575,1760 and 21 birr respectively (5 birr,32 birr and 7 birr for one lung, liver and heart respectively). Total average number of bovine slaughtering in the abattoir as 3980 annually. Therefore annual economic loss was determined by considering annual slaughter rate of cattle and prevalence of hydatidosis and hence calculated to be 54,679.25 birr per year due to organ condemnation.

Table 1: Prevalence of bovine hydatidosis at shire municipal abattoir at shire municipal abattoir, October- December, 2010

Months	No of cattle slaughtered	No of cattle positives	Prevalence (%)
October	200	50	25
November	250	67	26.8
December	90	23	25.56
Total	540	140	25.92

Chi² =0.04 (df=1, P>0.05)

Table 2: Cyst distribution of bovine hydatidosis in organ wise at shire municipal abattoir, October-December, 2010

Organs	No infected organ	Percentage
Lung only	85	60.71
Liver only	25	17.86
Lung and liver	27	19.285
Lung, liver and heart	3	2.14
Total	140	100

Table 3: Total numbers of organ condemned at shire municipal abattoir, October-December, 2010

Organ	No organ condemned	Prevalence (%)
Lung	115	66.47
Liver	55	31.79
heart	3	1.73
Total	173	100

A 5% carcass weight loss due to hydatidosis [14] was considered and average total number of animals slaughtered at Shire municipal was 3980 and the formula given previously to estimate the economic loss resulted 54,679.25 birr per annum and the indirect loss is 311,960.70 birr. So the total economic loss in the abattoir was calculated by direct loss plus in indirect loss which is equal to $A+B=54,679.25+311,960.70=366,639.95$ birr per annum.

DISCUSSION

In Ethiopia most cattle were generally slaughtered at their older ages, when they are no more needed for work. The same is true at Shire municipal abattoir, they slaughter at old ages. Therefore old cattle have had higher exposure possibilities to infection than young cattle by hydatidosis. The prevalence of hydatidosis is varied from year to year and from place to place, even from month to month due to difference in culture, social activities and attitudes to dogs in different regions and geographical locations.

The prevalence of hydatidosis in cattle was found to be 25.92% at Shire municipal abattoir during the study period. The result found in the previous study [16] was 28.09% in cattle in Mekelle abattoir. The present finding is slightly lower than that reported by Dawit at that study area. The difference may be due to decrease illegal slaughter, length of study period and which subsequently lead to reduced in infection rate in dogs. Reports in other parts of the country were; 55.6% in 1983 in Debrezeit, 24.3% in Gondar in 1987, 9.4% in Dridawa in 1987 as indicated in Feseha, [17] were recorded. In general terms, throughout the world, there had been different magnitude records of hydatidosis in cattle with low, medium and high rates of occurrences. Generally the variation in prevalence rate among different geographical locations could be ascribed to the strain differences of *E. granulosus* that exists in different geographical locations [18,19]. Additionally variability could be related with age factors. Other factors like different in culture, social activities and attitudes to dogs in different region may contribute to this

variation [20]. In human infection difference between religious and ethnic groups is merely a reflective of their relationship with dogs; Lebanon, for example higher prevalence of hydatidosis has been observed among Christians than Muslims who rarely keep dogs such as pets because the Koran instructs that they are 'dirty animals' [17]. Most of the slaughtered animals were old and hence they were exposed to the disease (parasitic ova) over a long period of time with an increased possibility of acquiring the infection. In the study area, the cultural and religious taboos favour the keeping of dogs often in close association with the family and farm animals. In the area almost all cattle owners, shepherds and urban dwellers keep a minimum of one dog.

Apart from this the number of stray dogs as well as wild carnivores is considerable and dogs are not deformed at all. These and other socioeconomic realities in the study area considered to be best suit the maintenance and further propagation of hydatid disease. Backyard slaughtering of ruminants is very common and few cattle are slaughtered in abattoirs. Most cattle are killed in backyards and roadsides. The wide spread tradition of offering uncooked infected offal's to pet animals around homestead, poor public awareness about the disease, the absence of proper fencing and disposal pits for slaughterhouses (where dogs and other carnivores get an easy access) and the habit of disposing dead wild or domestic animals, unburied and left open for scavenging carnivores creates favourable condition for environmental contamination by maintaining the life cycle of *E. granulosus* in stray dogs and wild carnivores.

The peculiar geographic feature of shire due to the presence of Tekeze River and bushy areas along the riversides is an ideal home for many foxes and hyenas. Hence, besides domestic dogs these wild carnivores play a significant role in maintenance of the life cycle and become potential source of infection for domestic ungulates. In this study, assessment was made to establish relationship between body condition and hydatid cyst count. Animals with poor body condition were found to have higher hydatid cyst counts and the poor condition among animals is probably a reflection of the effect of relatively high cyst burden. Battelli [21] explained that in moderate to severe infection, the parasite may cause retarded performance and growth, reduced quality of meat and milk as well as live weight loss.

In the present study it has been established that hydatid cysts prevalence of each organ at the abattoir survey (Shire) was found to have unequal distribution,

being predominately in the lung and liver with prevalence rate of 97.85% in cattle, in the lung 66.4%, liver 31.79% and heart 1.73%. The result found in the previous prevalence study [16] was: lung (63.82%), liver (33.22%), heart (1.316%) and kidney (1.64%) in cattle in Mekelle municipal abattoir.

Variations and deviations in localisations are possible. For example in the above the highest incidence of the lung (66.4%) followed by liver (31.79%) shown and is more or less similar to with that of Dawit's study results and in other organs somewhat lower. This is explained by the fact that lungs and livers possess the first great capillaries sites encountered by the migrating echinococcus oncosphere (hexacanth embryo) which adopt the portal vein route and primarily negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved. In addition, the lungs were mostly infected than any other organ this might be due to the fact that ruminants are slaughtered at older age [5].

Hydatid cyst count is highest in the lungs followed by liver and heart. Higher numbers of medium and large sized cysts were found in lungs of cattle than in the liver while the liver harboured higher number of small sized and calcified cysts. The reason for higher percentage of medium and large cysts in the lungs is due to softer consistency of the lung while the higher yield of calcified cysts in liver could be attributed to relatively higher reticulo-endothelial cells and abundant connective tissue reaction of the organ. The high proportion of small cysts may be due to immunological response of the host which might preclude expansion of cyst size [22].

Hydatidosis is the major cause of organ condemnation in Ethiopian abattoir and slaughter houses [23,24]. It is the second cause of liver condemnation next to fasciolosis and the first cause of lung condemnation in the abattoir. Therefore the present study result is similar to that of Meresie's findings. That is in Shire abattoir, a total of 173 organs, with lungs 115 (66.47%), livers 55(31.79%), heart 3(1.73%) were condemned during the study period. Therefore a total of 366,639.95 birr per annum is lost due to organ condemnation and carcass weight loss. The economic loss is increased from the previous study [16], with the total 304 organs, in the lung 194 (63.82%), liver 101(33.22%), heart 4(1.316%), kidney 5(1.64%) with the total of 92960.95 birr per annum. The difference may be due to the variation in the prevalence of the disease, mean annual slaughtered cattle in different abattoirs, variation in the retail market price of liver, lung, heart and beef.

Therefore, owing to the presence of socio-economic conditions favourable for hydatidosis and maintenance of high level of infection in the study area and considering the incalculable indirect losses from it, the epidemiology and control of hydatidosis is often considered to be a duty of veterinary professionals. However, collaboration between veterinarians and public health workers is essential for successful control of hydatidosis [25,26]. Hence, hydatidosis is one of the most important disease at Shire and its surroundings, warranting serious attention for its control and prevention. Enforcement of legislation that will an end to backyard and roadside slaughtering practices, establishment of policy on dog keeping and handling including registration, treatment and elimination of stray dogs, promoting construction of abattoirs with their appropriate disposal pits particularly in rural areas and conduct an obligatory meat inspection services.

CONCLUSIONS

Hydatidosis is a worldwide problem and in certain areas has serious zoonotic and socioeconomic importance. Hydatidosis is one of the highly prevalent parasitic diseases of cattle in shire and incurring huge economic loss due to organ condemnation and indirect weight loss. The disease is difficult to control due to backyard slaughtering, lack of adequate meat inspection and habit of raw offal give for their dogs. The result of the study shows that the disease is highly distributed. It is necessary to carry out special control program to combat the disease. However, for the program to be successful, further epidemiological investigations which break the possible chain of infections between the final and intermediate hosts and the role of wild life cycles under local condition are necessary.

Recommendations: The government should give attention towards building standard abattoirs with good facilities and control backyard slaughtering houses. Awareness generating/creating programs should be given for butchers, abattoir workers and dog owners as to the dangers of hydatidosis to human and animal health. Appropriate control measure should be taken to stop the sale of contaminated meat for pet animal's consumptions. Dog proof garbage collection and waste disposal system should be applied, particularly around slaughter places and abattoirs. Control of stray dogs should be practiced. Preventing of dogs access to raw offal is an effective measure. The measures to be practiced/ensured are disposal of offal at abattoirs, local slaughter houses and

peasant holidays. The authority should supervise slaughtering practices of carcass in order to prevent the illegal slaughtering of animals. The most important indispensable point is registration of dogs and the unregistered dogs should be liable to collect, eliminate and reinforce again by shooting of unwanted stray dogs, Euthanasia of unwanted puppies and kennelling, tying up or restricting working dogs to fence premises. And the dog owners should take their dogs to the veterinary clinics nearby for diagnosis treatment for tape worm infections.

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