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Prevalence of Bovine Hydatidosis and Its Economic Importance at Assela Municipal Abattoir

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Abstract
A cross-sectional study of hydatid disease was carried out in Assela Municipal Abattoir, East Arsi Zone in central Ethiopia during October, 2012 to March, 2013 in order to determine the prevalence rate of bovine hydatidosis and factors associated with the spread of disease, & the economic losses attributed to organs condemnation. The durable intent of the study was to make information available for the accomplishment of apposite control measures to trim down the transmission of hydatid disease. A total of 384 cattle of different age groups selected, and 170 (44.27%) of them were harboring cysts. The infection rate among different age groups were, statistically, significant (P<0.05). Proportion of 30.42%, 21.20%, and 10.60% cysts were small, medium, and large sized respectively, and 37.79% calcified cysts. Sterile, fertile and viable cysts represent 38.25%, 23.96% and 14.29%, correspondingly. Higher rate of cyst calcification confirmed in liver than in the lungs. 20,570.68 (Twenty thousand five hundred seventy birr & sixty eight cents) was confirmed as direct annual economic losses from organ condemnation.
Keywords: Bovine hydatidosis, Prevalence, Economic, Assela, Ethiopia

1. Introduction

Ethiopia has the largest livestock population in Africa, estimated at 38 million cattle, 23 million sheep and 18 million goats, which are raised almost entirely by the smallholder farmers throughout the country (Anon., 2005). Ruminants are particularly important resources of the country as they are means of cash income generation, from meat export, live animals, and skins (Sissay *et al*., 2007).

It was clearly recognized that parasitic infection of ruminants, cattle, are of major factors responsible for production losses in livestock in resource poor regions of the world (Perry *et al*., 2002). Most of these losses are caused by parasites, with the most important species of the genus being Echinococcus, nevertheless other parasites may also contribute to detrimental worm burdens in the animals (Urquhart *et al*., 1996). Echinococcosis/hydatidosis is a zoonotic parasitic disease (causes a serious public health problems) caused by the dog tapeworm, echinococcosus and its larval stage, hydatid cyst (Eckert and Deplazes, 2004). The parasite is found worldwide, representing the most important downside causing immense economic losses incurred from reduction in animal performance (traction) and weight gain (hide value & fecundity or fruitfulness decrements), condemnation of affected organs at slaughter, cost of treatment, and mortality in severe cases, (Fuller and Fuller, 1981).

Various investigation, in Yugoslavia, have documented that economical losses incurred from the reduction in milk and meat production as well as quality, due to this parasite, were about 10% & 5%, respectively (Polydorous, 1981). The present study, therefore, prompted with the most important intention of estimating the prevalence of rate bovine hydatidosis, and thrash out factors associated with the spread of the parasite. The durable intent of the study was to make information available for the accomplishment of apposite control measures to trim down the parasite transmission among animals.

2. Materials And Methods

2.1. *Study area*

The study was conducted from October 2012 to March 2013 at abattoir located in the town of East Arsi Zone in central Ethiopia, Assela. Geographically, the area situated at 6^0 59’ to 8^0 49’ N latitude to 38 ^{0}41’to 40^{0}44’ E longitude in central Ethiopia at a distance 175 km southeast of the capital city, Addis Ababa. Topographically, the altitude of the area ranges from 1,780 to 3,100 meters above sea level (m.a.s.l) and it is characterized by a mild subtropical weather ranges from5 to 28^{0}C. The major land cover is used for grazing and supports an average of 27 livestock per hectare. Agriculture, the leading economic activity of the area, contributes 75.6% of the total Gross Domestic Product. A mixed farming system covering 90% of accounting for 545.33% and livestock for 30.34% of the Gross Domestic Product is typical for the area. Sheep stands next to cattle as the dominant livestock asset in the zones.

2.2. *Study Population*

The study focused on population constitute of both local and cross breeds of cattle, where majority of them had been sourced from different markets located within boundaries of the region, and the annual cattle slaughter rate

were about 4,560, in average (according to questioning made to the slaughter house personnel).

The age of the animals was estimated on the basis of the dentations formula and grouped in to three categories as cattle with: full root of incisors (≤5 years of age), medial incisors showing wear and leveled (6≤9 years of age) and permanent incisors showing wear and space between teethes (≥10 years of age).

2.3. *Study Design and Sample Size*

Across-sectional study type was conducted for determining the prevalence rate of bovine hydatidosis, and factors associated with the spread of the parasite. And, both *ante-mortem* and *post-mortem examinations* were carried out following the standard routine meat inspection procedure. In post mortem examination, major edible organs of each slaughtered carcass were embarked on.

2.4. *Sample Size Determination*

Anchored in the previous survey, expected prevalence of 50% was taken to calculate the required sample size. The sample size was determined using Thrusfield, (1995), formula setting the 95% confidence level (CI) and 5% accepted error. To this effect, the obtained sample size was 384, and systematic random sampling procedure was also used during sampling.

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

Where: **n** = required sample size; P_{exp}= expected prevalence & d = desired absolute precision

2.5. *Study Methodology*

2.5.1. Prevalence Study

A three days per week, regular visit, were made to the slaughter house, and infected organ of any individual animal indentified, methodically which enfold visual inspection, palpation, incision, visualization and again palpation. Infected organs were collected for further close examination and registered, then. Incision was applied as necessary as to confirm any doubtful cases, also.

2.5.2. Cyst Characterization

Location of the cyst were registered and measured, carefully. The cyst size was grouped in to 3 classes, small sized cyst (< 5 cm), medium sized cyst (5≤10 cm) and large sized cyst (>10 cm).

2.5.3. Parasitological Examination

With the application of the standard routine meat inspection procedures enfolding visualization, palpation, incision & again visualization, post-mortem examination of organs such as liver, lungs, heart, kidneys, etc of each slaughtered animal was made for the detection of hydatid cysts. And, the presence of hydatid cyst, whether fluid filled or calcified or both cysts, was established by visual inspection, and fluid filled cysts collected into an icebox. Collected cysts were then transported within 12 hrs to the Parasitological Laboratory of Assela Regional Laboratory.

Cysts classified as fertile and infertile depending on the presence or absence of protoscoleces, respectively. Fertile cysts were subjected to viable test; test consists of examining the protoscoleces for its amoeboid like parasitalic motility under high Power Microscopic Examination, x40 objectives. When cases are doubtful, 0.1% aqueous eosin solution was added and viable one doesn't take the stain remaining white it was while non viable one retains the dye and appeared red, indication of dead cysts (Macpherson, 1985). Infertile cysts are further classified as sterile, fluid filled cyst without protoscoleses or classified cyst, cyst on the process of calcification or already calcified (Gracey, 1986).

2.5.4. Economic Loss Assessment

The loss due to hydatidosis was estimated on the basis of organ condemnation. Variable of importance considered in calculating cost of condemned of organs were: The mean retail of market price of an average size of organ for both local and cross breed, and estimation of average annual cattle slaughter rate. And, the total annual economic loss as a result of livers and lungs condemnation is calculated using the formula (Orgunrinode *et al*., 1980) (Annex-II).

$$\{(\mathbf{MAR} * \mathbf{PH} * \mathbf{P_1} * \mathbf{C_1}) + (\mathbf{MAR} * \mathbf{PH} * \mathbf{P_2} * \mathbf{C_2})\}$$

Where: **MAK** = Mean Annual Kill; **PH** = Prevalence rate of Hydatidosis; $\mathbf{P_{1/2}}$ = Prevalence of condemned liver/lung $\mathbf{C_{1/2}}$ = Cost of a single liver/lung mean retail

2.5.5. Data Analysis

Data on each sampled cow was collected in properly designed format for this study purpose, entered into Microsoft

Excel 2007 program of the computer and analyzed using STATA 12.0. The prevalence of hydatidosis was calculated as the number of cattle found infected against the total number of examined animals, expressed as a percentage of the total number of cattle slaughtered (Thrusfield, 1995).

The infection rate was calculated on the basis of age groups and analyzed to distinguish the different variables. The *Pearson's chi-square* (X^2) test was used to test the prevalence differences existed among the age groups. A statistically significant association between variables is considered to exist if the computed *P*-value is less than 0.05 ($P<0.05$). The economic significance of the problem was analyzed on the basis of secondary data on annual cattle slaughter rate and organ mean retail market price, (Table I).

3. Results

For the duration of the whole study period, from October 2012 to March 2013, a regular visit made to the abattoir house and a total of 384 cattle were examined. Of these, 170 (44.27%) were found infected with hydatiosis. Observation, besides, revealed 130 (33.85%) lungs and 87 (22.66%) livers, representing a total of 217 organs, were infected by cyst of hydatid. Prevalence of high infection rates (54.12%) were recorded in older animals, and statistical association or correlation between age of the animals and infection rates of hydatid cyst were slightly positive (r=0.002) (Table II).

With the intention of identifying the sizes, a total of 217 hydatid cysts were assessed & examined, out of which, 66 (30.44%), 46 (21.20%) and 23 (10.60%) confirmed small, medium and large sized cysts, in that order (Table V). The prevalence rates, corresponding to the sizes of the cyst, proved that small sized cysts represent the highest proportion while the large sized cysts signify of the least shares (Table IV). Out of examined cysts, 83 (38.25%), 72 (33.18%) and 82 (37.79%) sterile, fertile and calcified cysts were validated.

Moreover, it was indicated by the study clearly, from the total 52 (23.96%) of fertile cysts, 31 (14.29%) viable cysts were recovered (Table VI & VII). An assessment of the in progress retail market price of organs (lung and liver) from average size of Zebu and cross breed cattle revealed that 5.00 and 37.50 in Ethiopian birr costs for a single lung and liver, respectively. On that manner, the calculated annual economic losses incurred as a result of condemned infected organs were estimated at 20,570.68 (Twenty thousand five hundred seventy birr & sixty eight cents) in Ethiopian birr.

Table I. Average unit prices of organ (lung and liver) in Assela local market

	Breed		
Organs	Local	Cross	Average
Lung	5.00	5.00	5.00
Liver	35.00	40.00	37.50

Table II. Over all prevalence of bovine hydatid disease

Number of Animals		Organs engaged	
Slaughtered and Examined	Exposed	Lung	Liver
384	170 (44.27%)	130 (33.85%)	87 (22.66%)

Table III. Prevalence of hydatidosis in proportion to the age of the animals

Result	Age of the animals (by age groups)			Total
	Group I (≤5)	Group II (6≤9)	Group III (≥10)	
Unexposed	35 (16.36%)	96 (44.86%)	83 (38.79%)	214 (100.00)
Exposed	12 (7.06%)	66 (38.82%)	92 (54.12%)	170 (100.00)
Total	47 (12.26%)	162 (45.57%)	175 (45.57%)	384 (100.00)

Table IV. Cysts frequency distribution in association with lung and liver

Organs	Animals	
	Number	%
Lung only	83	38.25
Liver only	40	18.43
Lung and liver	47	26.66
Total	217	56.51

Table V. Cyst frequency distribution in lung and liver (Fertile Vs viable cyst)

Types of organs	Fertile		Viable	
	Number	(%)	Number	(%)
Lung	36	27.69	24	66.67
Liver	16	18.39	7	43.75
Total	52	23.96	31	14.29

4. Discussion

In this cross-sectional study, endeavor was made to have an insight on to the status of prevalence rates of bovine hydatidosis, and a prevalence of (44.27%) was obtained. Other comparable observation were also made in other region,37.7% prevalence in East Shoa by Yemane, (1990) and 46.5% prevalence in Debre –Zeit by Yilma, (1984). Still high prevalence (63%) was also registered in robe by Wubet, (1987) 54.8% in Arsi region by Alemayehu, (1990). Generally, the variation in prevalence among different geographic location is the stain different of E. granulosus exists in different geographic situation (Arene, 1985).

In this study, almost more than quarter of the slaughtered cattle was found infected by hydatid disease. The high prevalence may, generally, be related to the prevalence of favorable factors for the propagation and maintenance of high level of infection in the area, and particularly, it may be ascribed to the origin of the slaughtered animals which, in majority of cases, was form highland areas where the environmental conductions such as low temperature and high humidity, suitable for the survival of the eggs of E. granulosus to exist. The age of the slaughtered animals was also anticipated as one of the reason, contributing to the high prevalence of the disease in the area. Most of the slaughtered animals were old and probably culled when their working and production capacity has decreased, and hence they were exposed over a longer period of time with in an increased possibly of acquiring the infection..

The cultural taboos favoring the keeping of dogs in pre-domesticated areas, often with close association with family and farm animals, even to the extent of sharing; at times, the same accommodation. Personal observation also revealed almost all cattle owners, shepherds and urban dweller keep a minimum of one dog in order to safeguard their properties from wild carnivores and thievery. Some of these dogs were known to be infected with E. granulosus; such dogs contaminate pasture with their faeces containing Echincoccus eggs. People living in administrative region either in rural or urban did not take care of their dogs.

Not only stray dogs, those owned by the dwellers did also contaminate the pasture. These and other socio-economic realities observed in the area, therefore, considered to best suit for the maintenance and propagation of hydatid diseases. A prime important point was also the absence of legislation, had to enforce the zoo sanitary status in the region or in the country, in general. Extensively practiced and traditionally habituated back yard and road-side animal slaughter had contributed for maintenance of the cycle of the parasites.

In such condition, the transmission of dynamics of the disease maintained by those dogs, infected through ingestion of offal or organs harboring the cyst, and thus the parasite could be able to uphold its life cycle. The wide spread of tradition, accustomed to offering their dogs and cats with condemned offal, often uncooked; poor hygienic condition, absence of proper fencing (carnivores were easily entered & got access to condemned organs) and un proper burying of infected offal (vultures fed on and spread the infected organs, without difficulty) because of remained unclosed damping pits. The geographical feature of Assela, peculiarly predominated by bushy area became also an ideal home for carnivore such as foxes and hyena, playing a considerable role in the maintenance and propagation of E. granulosus tape worm and become potential source of infection for domestic ungulates.

The prevalence by age revealed that higher infection was recorded in animals with age 10 and above years (54.12%) and following by ages of between 6 to 9 years (38.82%), and the lowest prevalence was recovered in animals of age up to 5 years old. The difference in prevalence rate between the age groups were statistically significant ($P<0.05$). The reason to this age difference rate of infection is established that the prevalence of hydrated cyst increases as the age of animals increased (WHO/OIE, 2001).

The highest prevalence rate is, therefore, expected in order animals. It was also shown that in cattle, lung was more frequently affected than liver, 33.85% and 22.66%, respectively. This fact is in agreement with the result of Askedom, (2007), who indicated 77.5% & 45.6% lung and liver, and Mohammed, (1988) 69.5% lung and liver infection, respectively. The reason for these phenomena probably because that cattle are slaughtered when they become aged at which the diameter of the capillary increased (Gracey, 1986).

As most animal slaughtered with age of above 5 years, liver capillaries are said to be dilated that most onchospheres easily pass directly to the lungs, facilitating the condition for the hexacanth embryo to enter in to the lymphatic circulation, then to the thoracic ducts, heart and to be trapped in the lung, eventually. A lower percentage of cyst fertility was indentified (33.18%) and relatively high percentage, 37.79% and 38.25% calcified and sterile cysts were recorded, respectively, showing that the importance of cattle in maintaining the cycle in minimal level.

The variation in fertility, sterility and calcification was described as strain difference of E. granulosus (Arene, 1985), stated that strain of parasite and host can modify the infectivity of the parasites. The difference in

fertility of the cyst may also be attributed to the older age since increased number of fertile cysts tends to occur in older animals.

It has been documented that it may take 2-4 years for the occurrence of fertile cyst in animals (WHO /OIE, 2001); an important factor that can influence the transmission of E. granulosus are most likely found in older animals while sterile one is found in young animals. Depending on geographic situation, the nature of infected host and the site of infection/ organ type, cyst may also have different fertility rates. Higher proportion of calcified cyst (49.43%) were occurred in relative to lungs, (30.0), which probably could be attributed to relatively high reticulo-endothelial cell and abundant connective tissue reaction of the organ (Mohammad 1988), hence large number of onchospheseres are killed in this organ.

The commonest form of cattle hydatidosis is the smallest, uni-locular and sterile cyst (Gracey, 1986). Cysts in cattle are frequently sterile. Sterility of the cyst is associated with the age of the host at time of infection (Thempson and Allsop, 1988). In the present study, higher number of medium and large sized cysts, found in lung than in liver and most calcified cysts in liver due to the fact that lung is softened consistence. The annual economic loss incurred due to bovine hydatidosis at municipal abattoirs from lungs and liver condemnation was estimated at 20,570.68 in Ethiopian birr.

Similarly, different economic losses were also reported from parts of the country for instance, in Mekele abattoir, at 494,663.90 in Ethiopian birr, Yilma, (1984). The differences, in obtained result, existed in various abattoirs or region may be due to the variation in the prevalence of the disease, mean annual slaughtered cattle and the retail market price of liver and lungs.

5. Conclusion

Since hydatidosis has an adverse effect on the livestock production sector, for it causes huge economic losses, the interpretation must be made with a very serious and precautions. It is, therefore, concluded that hydatidosis is both from public health and to the most economically important diseases, warranting serious attention for its control and preventions. In view of the obtained result and prevailing socio-economic realities, the public must have to be educated on the danger of the disease to man and animals, and on the extent of economic losses, incurred; proper disposal and burying of infected organs, and veterinary supervision of individually owned dogs. Enforcement of legislation to put an end to back yard and road side animal slaughter, and investigation into the basic local epidemiological factors governing the dissemination of hydatidosis must have to be carried out.

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